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Summary of the Munich Electrical Exhibition.

(*Translated for the* REVIEW *from La Lumière Electrique.*)

We have delayed giving until now any detailed account of the Munich Electrical Exhibition, not desiring to begin until we could obtain all the documents relative to this new manifestation of electrical progress and such cuts as might be necessary to enable us to make the description as complete as possible.

If the exposition has not proved of as great importance as the one at Paris, it has at least presented many interesting features. Its remarkable organization for electrical measurement and the exhibit of machines and lamps wholly of German make, and but little known in France, have given special interest to the exhibition and added to the importance which it has already acquired in connection with the memorable experiments of M. Marcel Deprez.

The principal object of the Munich Exposition was to study the practicability of electro-technical application, to make the necessary measurements for a just appreciation of the value of these applications and, at the same time to judge critically of electric lighting from an artistic standpoint.

From the latter point of view a more appropriate place could not be found, for, aside from Paris, where artists of the entire world meet and devote their talent, the Munich school occupies a foremost rank both as regards the number and talent of its painters and sculptures.

At the Industrial Palace during the Paris Electrical Exposition in 1881 artistic applications of the new methods of illumination were quite limited.

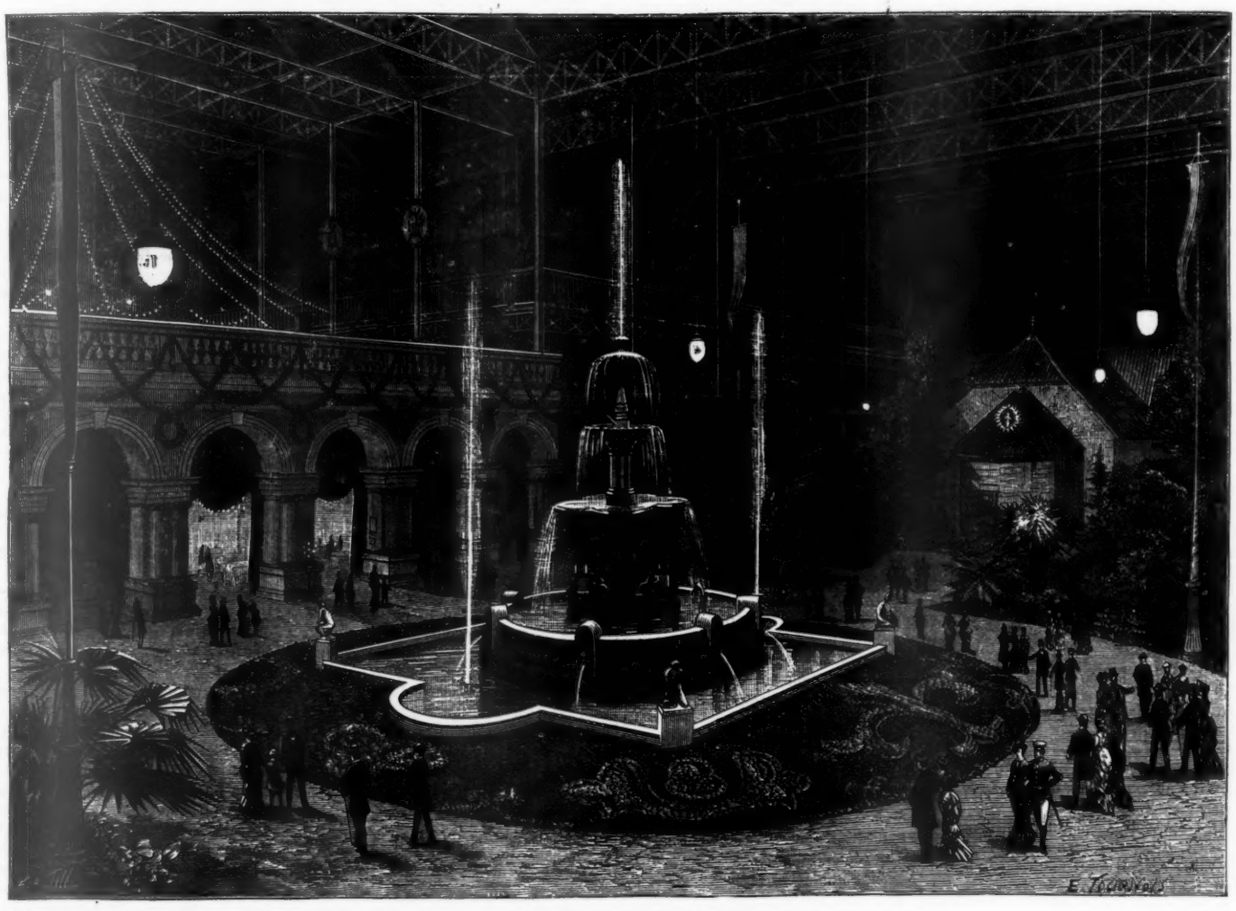
The saloon for paintings, lighted with the Poleil lamp, certainly produced a very happy effect, and the arrangement of the theatre and the apartments of the President of the Republic showed that marvels might be accomplished in the way of luxuriant lighting, but up to this time the lighting of museums and monuments had not been accomplished, while at Munich attempts of this kind were made with considerable success. All who visited the Bavarian capital at this period will recall the excellent effects produced by the Schekert lamps on the Fraventhürme and at the same time the electrical arrangements in certain streets. They will also recall the tasteful decorations of the various saloons filled with objects of art, and in which the light from elegant chandeliers illuminated in such a magnificent manner the superb products of Bavarian art.

From another point of view the application proper of electro-technics, the place was most favorable, for, if dynamo machines, with steam as a motive force, are susceptible of rendering important service, they must be still more serviceable when natural and less expensive forces can be made available.

Now, Munich is traversed by the Isar, whose magnificent falls are capable of producing thousands of horse-power. The natural force thus created is, moreover, not confined to a single point, for arms of the river traverse the city in various places, so that the utilized force has there already received a natural distributional beginning.

It will therefore be seen what an amount of interest the inhabitants of Munich ought to take in the study of electrical machines and motors, and above all, in the study of the transportation of force; and it will readily be understood why the Committee on Organization on learning of the statements advanced by M. Marcel Deprez relative to the transport of at a distance, urged that gentleman to give experimental proof of the same, and freely placed at his disposal every means for the complete demonstration of his hardy experiment.

Notwithstanding these favorable conditions, however, electrical industries were, until recently, but little known at Munich; but when Prof. von Beetz, of the Polytechnic Union, and Engineer Oscar von Miller, of the Society of Architects and Engineers, described before large meetings the marvels of the Paris Exposition, there was no longer among the members of the society but a single desire—that of taking up the study of these new inventions, which were being made so rapidly that the electrician himself could scarcely follow them, and determining for themselves by means of practical experiments their scientific and commercial importance



MUNICH ELECTRICAL EXHIBITION.

It was this desire, therefore, that gave birth to the Munich Exposition.

The organization of the Electro-technical Exhibition was begun in March, 1882, by an initiatory committee, of which the officers were as follows: President, Dr. von Beetz, professor in the Royal Technical School; vice-president, Mr. Friedr. Haenle, manufacturer; secretaries, Mr. Oscar von Miller, engineer, Chevalier J. von Schmaedel, architect.

At the same time a number of citizens, members of commercial houses, societies, etc., united for the purpose of establishing a guarantee fund, and Government aid was speedily obtained.

The opening took place September 16, 1882.

The objects exhibited were classified in fifteen groups, as follows:

I.—Historical apparatus, scientific instruments, and apparatus for instruction.
II.—Telegraphy and signals.
III.—Telephony.
IV.—Electro-medical apparatus.
V.—Batteries and accumulators.
VI.—Electro-chemistry.
VII.—Magneto and dynamo-electric machines.
VIII.—Electric lighting.
IX.—Motors.
X.—Apparatus and various utensils.
XI.—Cables, wires, and lightning arresters.
XII.—Bibliography.
XIII.—Electric measurement of time.
XIV.—Decorative arrangements.
XV.—Agriculture

But relative to the electrical tests to which they were to be submitted, these fifteen groups were reduced to twelve:

I.—Machines, accumulators, and cables.
II.—Historical apparatus, scientific instruments, and apparatus for instruction.
III.—Motors, measurement of work and resistance.
IV.—Photometry.
V.—Telegraphic apparatus.
VI.—Telephony.
VII.—Fire alarms, controlling apparatus, bells, and electric clocks
VIII.—Machines and apparatus used on railroads or for army purposes.
IX.—Batteries, electro-installurgy, and electro-chemistry.
X.—Electric therapeutics.
XI.—Artistic study of electric lighting.
XII.—Applications of electricity to agriculture.

For the study of the apparatus thus classified the examining committee was divided into twelve groups, with the following presidents and vice-presidents:

I.—Dr. von Butz.
Dr. Kittler.
II.—Dr. von Jolly.
Dr. Himstedt.
III.—Prof. Ochroeter.
Mr. Poellath, Engr.
IV.—Dr. Voit.
Dr. Kruss (Hamburg).
V.—Conseler Seifert.
Mr. von Hoesslin, Engr.
VI.—Conselor Seifert.
Mr. Beringer, Inspector of Telegraph.
VII.—Dr. von Bezold.
Mr. Lautenschlaeger, Chief Mechanician of the Royal Theater.
VIII.—Mr. Beringer, Inspector of Telegraph.
Dr. Carl.
IX.—Mr. Heule.
Dr. Stoelzel.
X.—Dr. von Schauss, Director of the Mint.
Dr. von Ziemssen, Counselor.
XI.—Dr. Stinzing.
Baron von Perfall.
XII.—Chevalier von Schmardel, Architect.
Prof. Wolluny.

The exhibition was held in a building composed mostly of glass, which had formerly been used as a conservatory for the Botanical Garden, and in which it was situated.

Although covering a large area, the Crystal Palace of Munich was not supplied as our Palace of Industry was with galleries, and consequently everything had to be grouped on the ground floor. This was done, however, in a very successful manner, and in a way too that produced a very pleasing effect.

Our illustration on the first page shows the appearance of the centre and right-hand side of the exposition as seen from the entrance, the eye being first arrested by the large fountain whose jet during the evening, when illuminated by the electric light, produced a most magnificent effect, which was still further heightened by illuminating the two side jets with colored lights. Right opposite the entrance and behind a colonade covered with garlands was the buffet, which was illuminated by Edison chandeliers and numerous Swan lamps artistically arranged.

In the central nave, on the right, and amid an elegant group of shrubbery, was a chapel so arranged as to give an idea of electric illumination in churches. Next, a large picture gallery lighted by Schaefer lamps, which enabled one to judge of the effect produced by the light on the fine pictures it contained. Leaving this room one entered a drafting room lighted by Edison lamps, where numerous models exposed to the light showed that this illuminant answered perfectly for evening school uses. Still further, towards the right of the nave, was a large space in which the Northern Railroad Company had grouped the different electrical appliances in use in its service.

(Continued.)

Preparation of Carbons for Electric Lighting.

M. Jacquelain has endeavored to prepare carbon of like density and conducting power to gas-carbon and without its impurities. He removes impurities by three processes:

(1) Treatment with dry chlorine at a red heat for thirty hours to remove silicia, metallic oxides, and hydrogen. (2) Treatment with fused potash or soda. The alkali must not be too strong nor the temperature too high; Na_2O, with three equivalents of water answers well. An immersion of three hours is generally sufficient, after which the carbon is washed with water, then with dilute hydrochloric acid, and again with water. (3) Immersion in hydrofluoric acid diluted with twice its weight of water from twenty-four to forty-eight hours at a temperature of 15° to 25°. The gas carbon may be submitted to either of these processes after being cut into pencils. To restore the carbons to their original density they are carbonized by being strongly heated for a few hours in the vapor of some heavy hydrocarbon. Pure graphitoid carbon may be prepared directly by passing the vapor of some heavy hydrocarbon through a fire-clay tube raised to a temperature of 1,000° to 1,200° C. Hydrocarbons with high boiling points answer best, and gas tar is the most suitable for use on a commercial scale. The steadiness of the light and durability of the carbons are in direct proportion to their hardness, density, and purity. The best results in experiments have been obtained with Siberian graphite (sp. gr. 2.3, gas carbon being 1.9) purified by treatment with hydrofluoric acid, by which process the percentage of ash was reduced from 8.674 and 5.184 to 0.767 and 0.900.

Submarine Cables.

The construction and laying of a submarine cable is not at the present day looked upon as a feat of any considerable magnitude. Many, no doubt, will recollect the days when the laying of a cable was made the occasion of great festivities at the localities connected by the submarine link, but now a matter of the kind is one of such very ordinary occurrence that it is not considered worthy of greater notice than that afforded by a short paragraph in a spare corner of the daily paper.

The changes which have taken place in cable manufacture since the first successful cable was laid (but 30 years ago) have not been very marked, though they have added considerably to the insuring of success. The present type of armored cable, the general idea of which was, we believe, first suggested by Mr. Newall, has been adhered to in the main since its first introduction, and it does not seem likely to be superseded. First we have the insulated core, then the hemp padding and afterward the iron sheathing. In the original cables this practically completed the whole arrangement, and even at the present day it is in somes cases adhered to, though we think it is a mistake to do so.

The first decided improvement introduced was that adopted in the 1865 Atlantic cable; it consisted in sheathing each of the protecting iron wires with a coating of yarn. This had the advantage of preventing the ends of a broken wire from projecting and catching in the paying-out machinery during the laying operation, an accident which would be almost certain to have a serious termination.

This device has been superseded by the simpler and more effectual plan of sheathing with bare wires, as in the older type of cable, and then covering the whole with yarn and Clark & Bright's silicious compound.

A still more recent improvement consists in the serving of the armored cable with a double layer of tarred tape, well covered with the silicious compound. This gives the whole cable an excellent finished surface, while the tape most effectually prevents broken ends of the iron sheathing from protruding, much more so when the yarn serving was employed.

There can be no question but that this last improvement is a very decided one. The use of wet yarn for the serving immediately over the insulated core was first carried out in the Atlantic cable of 1866, and the practice has been continued ever since, so that any slight fault which may exist in the insulated core is certain to be detected during the course of manufacture.

In the construction of the insulated core itself there does not appear to be very much room for improvement; a conductivity of at least 96 per cent. of pure copper for the conductor is obtained with perfect ease, and no lower standard would be admitted.

As regards insulation there is no room for improvement with respect to the maximum value it should have; indeed, as we have more than once pointed out, the statement that a particular material must be of exceptional value because its specific insulation is extremely high, is of little or no account except to delude the public. The clause that specifies that the insulation resistance of a cable shall not be below a certain value is really a very slight guarantee that the cable shall be good, and if manufacturers were to adhere merely to the letter of a specification they could easily insist on what is practically a faulty article being accepted. Good electrification with high battery power, which is one of the best proofs of the soundness of a cable, is seldom if ever specified for; there seems, indeed, to be a dislike to altering established precedents although they may be quite out of date. With any respectable manufacturer who has a name to lose, a mere outline specification is practically as binding as one full of details, but if the latter are given, they ought, as far as possible, to be complete.—*London Electrical Review.*

Electric Lights for Harlem Bridges.

Engineer Van Winkle was instructed at Wednesday's meeting of the Park Commissioners to supply sufficient steam power on the Madison avenue bridge to operate the draw and work an electric light system. It was stated that the bridge would probably be completed by January 1, 1884. The Commissioners decided to have Ryer avenue opened from 135th to 141st streets. The treasurer of the Board was requested to ascertain the price of a dynamo machine, to be used for lighting the Third avenue bridge. This resolution, offered by Commissioner Viele, was laid over:

"That plans be prepared for the improve- of the Harlem River front in connection with the improvement of that stream by the general Government; and that the topographical engineer be instructed to report what areas along said river can judiciously be converted into permanent basins."

Electric Light in Arizona Mines.

A number of mining companies in Arizona Territory are about to adopt the electric light, to facilitate operations under ground, as well as on the surface, notably the Silver King Mining Company, the Howell Smelting and Mining Company, and the Conger Mill and Mining Company. At the Silver King mine it is proposed to use four 3,000 candle-power Brush lights above ground and two below, together with twenty-five small incandescent lamps. The dynamo located near the main shaft will supply the current descending 800 feet to the lower levels of the mine to the arc lights and storage boxes, from which latter the Swan lamps are to be connected by small copper wires. Fixed lamps are to be suspended from the roofs of galleries, and the portable lights are to be attached to flexible conductors for convenience of shifting. These lights are to burn continuously, night and day. In the reduction works of this company both large and small lights are also to be used, a separate dynamo and two storage batteries supplyiug the current. The arc light circuit in the Silver King mine will be about half a mile in length.—*Arizona Citizen.*

Thomas A. Edison and a number of other electricians happening to meet recently in the Western Union office at New York, the discussion which followed took the direction of recent developments in electricity. Incidentally some one spoke of the indefiniteness of the various terms employed to designate the measurements of electrical force, and said, "Ohm, for instance, and volt and ampere; what real idea of power do these terms convey?" "Oh," said Mr. Edison, smiling, "those are very useful terms. They serve to conceal our ignorance of electricity, which, as we all know, is in its infancy."

The Electric Light.

A FIRST INSTALLATION BY THE BRUSH-SWAN COMPANY.

The Brush-Swan Electric Light Company, which is to do for the interior houses what the Brush Electric Light Company has done for the streets, began lighting up the Central National Bank at Broadway and Leonard streets with small incandescent Swan lamps, fed from storage batteries furnished by Mr. Brush.

The lamps were made in Boston under an agreement with the English Swan Electric Light Company. The batteries were made in Cleveland.

The system, so far as it is known, was fully explained last winter, when the offices of the Brush Company at Broadway and Fourteenth street were lighted up in similar fashion.

The Swan lamp is similar in some respects to the Edison lamp—a glass bulb having a carbon filament which is heated to incandescence by the electric current, air having been exhausted from the bulb. When the exhibition was given at the company's offices in December, it was said by the officers of the company that batteries would be manufactured by the hundred at once, and the incandescent light offered at the price of gas. Some contracts were made to introduce the light, but the company has delayed the work until it may be winter before the batteries begin to arrive here in any number. The Central Bank was one of the first to make an agreement for the new light. It is as satisfactory as was the light shown at last winter's exhibition, being bright and perfectly steady. The batteries are contained in long, coffin-like boxes, which may be placed in any convenient spot; they are fed by wires running from the street poles of the Brush Company, the same wire doing service either for feeding an arc street light or charging a house battery.

This installation is the first that has been made by the Brush-Swan Company. The Madison Square Theatre expected to have lights of this system working by the first of last June. The fixtures have been in place

since May, but the batteries only arrived last week. One cause of this delay is said to have been Mr. Brush's desire to devise some method by which the lights could be diminished or increased in brightness for theatrical purposes without wasting the current from the storage batteries. He is said to have succeeded in this, and the system will be, according to the company's officers, in working order before the end of August.

Random Flashes from New England.

IV.

ARNOUX-HOCHHAUSEN SYSTEM.

The lighting machinery of the Arnoux & Hochhausen Electric Company, whose business office is at No. 221 East Twentieth street, New York, is comparatively little known in New England, and in fact little systematic effort has been made throughout the country towards its general introduction. The name of W. Hochhausen appears on the patent records of the United States with those of Farmer, Fuller, Weston, Loutin, Brush and Edison as an inventor of electric generators, and his dynamo is said to have been among the first installed for permanent public lighting in this country at Manhatten Beach in 1878. The dates of his principal patents—September 22, 1874, August 22, 1876, February 17 and October 19, 1880—show that modifications of original ideas were made from time to time, as the science was deve'oped, until in 1881 the company succeeding to the rights thus secured were enabled to furnish, at the inaugural ball in honor of President Garfield, one of the finest illuminations ever witnessed up to that time.

The prominent claims made by the company, which seem to be borne out by experience so far as the apparatus has received thorough tests, are for simplicity of construction, reliability of operations, as illustrated at the Weehawken Tunnel through the Palisades, New Jersey, where it has been used for blasting operations eighteen months without repairs under peculiarly trying conditions, and economy, as evidenced by the result at Taunton, Mass.

Here a plant was started about a year ago, largely through the efforts of the present manager, the local company having a capital of $15,000, with officers as follows:

President—Marcus M. Rhodes.

Treasurer—Wm. E. Fuller.

Manager—D. L. Mitchell.

Directors—N. H. Skinner, Dr. N. Page, A. G. Williams, M. M. Rhodes, Wm. E. Fuller and D. L. Mitchell.

Atract of 6,000 feet of land centrally located on the bank of the river, yet held only at a moderate valuation, was secured and a temporary wooden structure—28x40—erected, which is likely to supply the necessities of the company's work for some time to come.

A Buckeye engine capable of running dynamos for eighty lamps makes 172 revolutions, giving 890 turns to the three generators which have the past season supplied forty lights four nights per week and ten lights the evenings of the two remaining week days. No effort has been made to secure lighting for the city.

At the annual meeting (about June 1) the stockholders reviewed the work of the seven months preceding, which yielded $2,985 (at 60 cents per lamp per night) and cost in labor, power and maintenance, $1,813. Two quarterly dividends of 2 per cent. each have been paid, and as a supply of coal, carbons, &c., sufficient to last through the short evenings until October 1 was reported on hand, and a good balance in the treasury.

The secrets of this successful season seem to be the efficiency of the system itself, careful original construction, rigid economy in expenses and absence of competition. That the steadiness and other desirable features of the light have made a favorable impression is evident from the fact the full number of lamps is called for every Saturday night, and all have expressed their intention of using the system regularly with the return of the long evenings.

As is well understood by those who have investigated the Arnoux system, the armature is composed of sectional rings, and by withdrawing a bolt it may be opened and any damaged coil slipped off and another substituted. The lamp is also very simple.

Three other plants are in operation in New England, about 60 lights at Portland, Me., where the Weston system offers active competition; about 50 at Lawrence, Mass., and a small system at Dover, N. H.

The New England branch has an office at No. 68 Sears Building, Boston, and the interest which the treasurer manifests in the spread of information regarding the system may be illustrated by a little dialogue which took place there the other day:

"Mr. B——?"

"Yes."

"I represent the ELECTRICAL REVIEW of New York, and would like to make some inquiries as to your system."

"I have no time to talk about it."

"Perhaps you do not understand my object, sir; I propose to give to the public through the REVIEW an idea of the merits and progress of the Arnoux system in New England."

"I can tell you nothing about it."

"Is there any one connected with your company who will do so?"

"No!!"

A note to the competent and gentlemanly electrician of the New York office, H. R. Boissier, called out several valuable items of information showing that there is in the machinery of the company, if rightly and energetically managed, a foundation for a prosperous business.

In a telegraph office: "What is the charge to Blankville?" "Ten words for twenty-eight cents." "Why, it used to be twenty-five cents." "Yes, but that was before the strike. The additional three cents is for the postage stamp."

Electricity vs. Gas in Albany, N. Y.

OPINION ON MAYOR SWINBURNE'S VETO—INTERVIEW WITH SECRETARY MAHER.

A reporter passing down Trinity place recently, accosted Hon. E. A. Maher, secretary of the Albany Electric Light Company, as that gentleman sat in his office door at the works on that street, and stopped for a chat. The Mayor's veto of Alderman Mead's resolution, calling for additional light in places where dense foliage obscured the lights, naturally became the topic of conversation and the reporter was invited into the office, when interesting facts pertaining to the electric light system, its cost, etc, were gleaned. Regarding the statement in the Mayor's communication that the appropriation for gas is already exhausted, Mr. Maher said it was undoubtedly true, since the budget as made up last year appropriated $4,000 for gas, about $3,500 of which was to pay a deficiency of the year previous. At the time the budget was made up there were seventy-five gas lamps, and that number was reduced to fifty a short time afterwards, and reductions have since occurred, until now throughout the entire city there are but four gas lamps—two of the Albany and two of the People's Company—now lighted. As these lamps cost per light $35 per year each, and if they have not been paid for the whole year the deficiency would be but $140, and in any case it cannot exceed the sum of $500. As to the appropriation for lighting the streets, he understood that some time ago there was money enough to pay the expenses of the oil department until November 1st, and as to the electric light, there is still, he said, in the hands of the Chamberlain to the credit of the electric light account $28,000, a sum more than sufficient to pay the account to the end of what was designed at the time the budget was made up as the fiscal year. The new charter has changed the time of the fiscal year, and counting two months of what would be the next fiscal year if there had been no change, then there is no provision made. All the departments, so far as that matter goes, will be deficient after November 1st, and the city officers will be unable to draw even their salaries.

Speaking of the figures given by the Mayor ($14,000) that will be necessary for lighting the city, the secretary said he could not understand where these figures are got from. In the last budget there was $119 000 appropriated for lighting the city. In that sum was included a deficiency of $16,896.37 for electric lighting, about $3,500 for gas, and $3,000 for oil, making a total deficit of about $23,396.37, and leaving a balance of a little over $95,000 for the actual lighting expenses of the year. That year will expire November 1, and the only real deficiency that will be necessary to make up is that of about $500 for gas.

The question of cost relative to that of gas under the old system and electricity under the new, was then discussed, and as this is a most important question in which the people are at this time interested, Mr. Maher's views will be read with interest. He said that every one must concede that before the electric light was introduced Albany was justly considered the poorest lighted city in the United States; now all people admit that it stands foremost as a well-lighted city. In order to light the city with gas, and have the same volume of light as now given by the electric, it would require at least three gas lamps for each electric light, and of the $65,000 that was appropriated for lighting the city last year before the electric light was introduced, about $50,000 was paid for gas. If to light the city as it was lighted then with gas cost $50,000, to light it as it now is would consequently cost three times as much. The light now in this city is cheaper than in most of the cities. In New York 70 cents per lamp is paid, Baltimore 70 cents and Boston 75 cents.

This drew from the reporter the remark that Albany pays for its lamps, posts, and in fact all the apparatus necessary for the street lighting.

That is true, said Mr. Maher, and as the Mayor states, there has been expended about $46,000 for lamps, posts, wire, poles, construction, etc. These lamps, etc., have been furnished to the city at the actual cost to the company, and looking at the amount in the light of a permanent investment the interest on that sum would be about $2,700 per annum, when if the company agreed to furnish lamps and other paraphernalia at their expense and should receive the additional 20 cents per lamp that is paid in the cities named, it would increase the amount $28,000 per year, if they had the same number of lamps in use as here. Under the gas contract the city purchased the lamps and posts, and paid for each lamp received the sum of $4; for each lamp rest, $9; for stand pipe, refitted, $4; and each new lamp fitted up $13, this being in addition to the $35 paid for lighting each gas lamp, besides many other items.

The Mayor also speaks of carrying the lights into the rural districts, continued Mr. Maher, when in fact we light from Prentice's gate on the south to North street, North Albany, on the north; from New York Central avenue on the west to the river front on the east, all within the city limits, taking it as a presumption that people living on the outskirts, who pay taxes, are as much entitled to the benefits of these lights as those living in the heart of the city. Another thing, according to the police statistics, crime has been reduced during the past two years, and still another effect has been the lessening of drowning cases along the river front, when before the introduction of the electric along the river front in previous years the death rate, through people walking overboard, has been very great. Now it has been moderately reduced, not a single case occurring during the present year. There has been no additional lights started since the 30th of last December, nor has a lamp-post been placed since that time, excepting the two in front of the New City Hall, and those the City Hall Commission paid for. The electric light works, he said further, was now running to its utmost capacity, and has been for some time. Orders are now on the books for city lights dating from March 12th, last, that the company has been unable to fill for the reason that the demand for this light has been so great they have been obliged to use the balance of their plant to supply the demand of private customers, from whom the company received in many cases better prices than those paid by the city, and the demand for the light has exceeded the supply. But the company expect to give a public exhibition before September 1, of their new storage system, and they have no doubt that before January 1, next, they will be prepared to furnish the new incandescent light for stores, theatres, churches, public buildings and dwellings. If this is accomplished the company in the future will care little whether or not they have the street lighting.

Another mistaken view has been allowed to creep into the minds of the people regarding our stockholders, said Mr. Maher. The impression has gone forth, and still prevails to a great extent, that our stock is controlled by gentlemen-politicians of both sides. But it is not so. Neither Mr. John F. Smyth, Daniel Manning or Michael N. Nolan own one dollar of the electric light stock. Mr. Smyth did own twenty shares, but when he embarked in the banking business he sold out, at par, to Mr. William M. Whitney; Daniel Manning also held stock at one time, but he, too, disposed of his stock to Walter F. Hurcomb, while ex-Mayor Nolan never had one share in the company, nor has he ever been inside the company's office. The principal stockholders of the company at present are Wm. M. Whitney, W. F. Hurcomb, Hon. A. B. Banks, J. W. Tillinghast, A. N. Brady, Hon. N. D. Wendell, Robert C. Pruyn, O. S. Hascy, Henry Rosenthal, J. I. Wendell, John Winne and H. W. Sage. The company has paid no dividends, and it is impossible to say when one will be declared, but the company is not alone in that, as it is said no electric company has as yet paid a dividend on any of its stock.

Coming back to the Mayor's veto, Mr. Maher stated there was no intention under Alderman Mead's resolution, of placing the electric lights in streets where the foliage is dense, for the reason that when the leaves are off the trees there is all the light required—or in other words, for nine months in the year they have all the necessary light.

Mr. Maher, in concluding, thought the Mayor's message had been written in the interest of the gas companies, and expressed the hope that whoever wrote it would, in the future, if he had any mud to throw at the Electric Light Company, confine himself to facts as they exist.

Light Without Gas.

The first public experiment in St. Louis with the Brush-Swan electric light was made in the rooms of the Brush Electric Association, Granite Building, recently. The middle room was brightly illuminated by three Swan electric lamps, whose bright, steady glow seemed the perfection of house-lighting. These lamps consist of a clear glass bulb, about an inch and a half in diameter, in which a carbonized stalk of grass is coiled in vacuum. The lights are fed from a strong battery that is charged from the dynamo in the Walnut-street station in daytime, the same machine supplying the circuit of sixteen arc lights in Olive street direct each evening. The storage battery consists of a box containing cells, in each of which are lead plates immersed in a weak solution of sulphuric acid. The battery is provided with an automatic switch, attached to which is a meter. The switch automatically regulates the charge, and the meter registers the amount of current used. The great advantage claimed for this system is that the dynamo machines can be kept running constantly, storing up electricity, and every one who uses the light has his reservoir on his own premises. The lights exhibited last evening were absolutely steady, while it is said those fed directly from the dynamos are not. The Brush-Swan light is certainly the prettiest yet seen in St. Louis. To a *Chronicle* reporter, Mr. Bates said the company is ready to furnish these lights to householders at the

price of gas. He expects the first to adopt it will be the hotels and large business houses, who already have the Brush dynamo engines for their large arc lights. The company has contracted to put up twenty-four arc lights in Franklin avenue, four or five more in Sixth street, and several in Fourth and Walnut streets. Darkness will be banished from St. Louis in the course of time.

Induced Currents in Reciprocal Movements.

In an article published by du Moncel, on Dec. 16, 1882, upon the effects produced in the Griscom motor, he showed that when one of the poles of a permanent magnet is moved before a straight electro-magnet there are three successive induced currents: 1. The one resulting from the approach of the magnet, which is inverse and momentary. 2. Another, which is manifested during the whole passage of the magnet before the magnetic nucleus, and which is indirect. 3. A third, resulting from the removal of the magnet, which is momentary and which, although in the same direction as the first, corresponds to a direct current, because the inductive current is then exerted on an opposite extremity of the magnetic nucleus. Of these three currents only one has the same energy at the different points of the magnetic path. It is the one which corresponds to the passage of the magnet from one end to the other of the nucleus, and it belongs to the category of currents which du Moncel has called currents of polar interversions, and which he is now investigating. —*La Lum. Elec*, Jan. 27, 1883.

Constitution of the Sun.

In the third part of his discussion of the physical and mechanical constitution of the sun, Faye states that the solar refraction is insensible, and he has been able definitely to establish the fact that the mean depth of the spots is fully $\frac{1}{200}$ of the solar radius or more than 2,000 miles. This power of penetration is not peculiar to the sun; it is found to a high degree in our own atmosphere. A cyclone or a tornado which begins in the region of the cirrus clouds, at a height of 4 or 5 miles, descends vertically to the ground; if in its course it meets a deep valley it descends again until it touches the new soil, on which it manifests the same strength as upon an elevated plateau.

On the sun the obstacle is not the soil; it is the specific lightness of the gases, which are drawn into layers of increasing density until the work of which the whirl is capable has been completely exhausted.

In our cyclones and tornadoes, which draw only air, and not a gas which is specifically lighter than air, the air possesses nearly the same density as that of the surrounding medium; there is, therefore, only a feeble ascensional tendency. The atmospheric equilibrium is reëstablished without the return of the whirling air to the higher regions. It is evident that the case must be far otherwise in the sun, where the descending gas is hydrogen. This gas, superheated in the lower regions, will soon remount far above its point of original departure and above the chromosphere; that is to say, into the almost complete vacuum of the coronal region, giving place to that astonishing apparition of luminous protuberances, which the beautiful discovery of Janssen and Lockyer allows us to study daily on the sun's circumference. This hydrogen is often seen to fall back to the sun in different forms; sometimes in tongues of fire, imitating a sort of rain, at other times by a collective movement, as if by a slow subsidence. The chromosphere, which is receiving the materials of these protuberances, does not sensibly change its level. The circulation of the hydrogen is, therefore, mostly vertical and due to gyrations of different magnitudes in the photosphere. The formation of faculæ and pores, and the various other changes of the sun's surface, are all explained mechanically by the same gyratory movements.—*Comptes Rendus.*

An Electrical Launch.

A launch propelled by stored electricity made a trial trip between the Temple and Greenwich, Eng., recently, being one of the first instances of the use of this motive power thus applied. The launch, which is only forty feet in length, was built of galvanized steel by the Messrs. Yarrow & Co., of Poplar, and the propelling power is found by Messrs. Siemens' dynamos, placed under the flooring of the stern of the boat, which is raised there about eight inches. The electricity for giving the motion to the dynamo is obtained from Faure-Sellon-Volckmar accumulator cells, supplied by the Electric Power Storage Company, placed under the flooring, where they not only do not occupy space available for passengers, but are useful in forming ballast. There is storage sufficient to give very high speed for six hours or a longer time with a medium speed. On the ordinary launches the machinery and attendants occupy the larger and better part of the vessel, but on the one tried on Tuesday the only machinery seen was the steering geer, and one man steered and managed the whole, there being room for more than forty persons. There was in the traveling no noticeable vibration, and the absence of smoke was not only apparent to the travelers, but to the workers on ships in the pool, who hailed the little craft with the query as to where the funnel was. The boat arrived at Greenwich in three-quarters of an hour. The makers present the craft as possessing qualities especially adopted for warfare, for she is noiseless, is ready in a moment when the accumulators are once charged; and the electrical power is easily obtainable on board ship from the engine or from water-wheels. The trial was quite successful, and Mr. Yarrow, representing the builders, and Mr Collett, representing the Electrical Power Storage Company, were congratulated on the result of the day.

Potential, Current, and Resistance

By John T. Sprague.

In Vols. II. and III. of the London *Electrician* there was a prolonged discussion on the subject of Potential, in which several eminent electricians took part, and which, if it did not clear up the subject, made it very clear that there existed much difference of opinion about it. In papers by myself at a later paried on the transmission of large currents, the constants of the electric current, and current force and energy, I endeavored to work out some ideas of my own as to the nature of electromotive force, and the analogy between electric currents and those of water, but did not carry this out completely. Having had recent occasion to examine the subject again, with the result of further developing some points which appear to be of interest, I propose now to present them fully worked out, though in so doing I must of necessity again go over the matters contained in former papers. As force is the origin of action, conduction its channel, and current the result, that order of consideration might appear reasonable, but these divisions cannot be wholly maintained, and I do not propose to attempt it, but shall take the various subjects as they come convenient.

1. Current is most easily conceived because it deals with actual tangible facts in nature, while the others are matters of calculation. Currents in electricity, as with water, means the rate of passage of unit quantity across any section of the conductor; its most definite evidence and measure is the chemical action produced by the passage of electricity through liquids. Unfortunately, the accepted unit of electric quantity, the coulomb, does not accord definitely with the natural unit

$$\frac{\text{atomic weight}}{\text{valency}} = \text{electric equivalent},$$

which would make one of hydrogen represent the unit of electric quantity, and, with the element of time, the unit of current; but though only a fractional value represents the relation, and it is not even settled whether the real value of the coulomb and ampere is .00001022 or .000010415 of a gramme, still this is the true physical representation of electric quantity, which corresponds to "mass" in mechanical calculations.

2. In the older works on electricity, "quantity" currents and "intensity" currents were spoken of, and even now we occasionally meet with such an unmeaning phrase as the "tension" of a current. All such ideas, which give the impression of some difference of nature in currents, are misleading. Current, as such, has only one quality, its rate; a given current, that is, one which will produce a certain deflection in a particular galvanometer, or will deposit a certain weight of metal from a solution, is exactly the same in its nature and properties whether it comes from a large or small cell, from a single cell, or from a thousand cells in series. But the same current may have different effects according to its *density*, that is, according to its ration to the sectional area of the conductor, or its quantity per unit of area. This influences the temperature generated in wires, and is of supreme importance in electrolysis, so that it is unfortunate that some writers have taken to using the already misapplied term "intensity of current" for this ratio.

3. Ohm's Laws.—These laws or formulæ are universally employed by electricians, but are not confined to electricity, as they express the common fundamental mechanical laws. The relations established by Ohm's laws between electromotive force, resistance, and the current and its work, are simply the well-known laws of mechanics or the relations between force, such as gravity, weight, and velocity, and the laws themselves are merely mathematical expressions. Invaluable in dealing with the modes of operation, they only delude us if we regard them as facts, and do not clearly trace out the reasons why they are valuable. Mr. Oliver Heaviside has made some remarks on this subject (pages 149 and 150), in which this matter seems to be curiously undervalued, when, after referring to the confusion in some minds as to electric resistance, he remarks that "R is just called so," and again, "if ideas are correct, it is of secondary importance what language is used to express them" But that is just the point; a writer's ideas may be correct, but when he has to use words which have already an entirely different meaning, it is by no means sure that his readers' ideas will be correct. It is in fact only quite lately, and in no degree consequent upon the teachings of the professional teachers of electricity and their formulæ, that people are beginning to understand that R, the electric *resistance*, is not resistance at all as commonly understood. When he suggests that the fact that this so-called resistance presents no more obstacle to a large current than to a small one (p. 199) is a powerful argument in favor of providential design, one is apt not only to smile at his suggestions of a soporific, but to doubt whether he has himself fully realized that the fact itself results merely from an arithmetical artifice explained in my earlier papers referred to, and which I shall recur to in due course.

Multitudes of students are misled by this misuse of the word resistance, and eminent electricians and engineers have been equally deluded. Mr. Siemens said in a public lecture: "My critics have, however, fallen into the error of overlooking the fact that half a unit resistance is the same for a circuit capable of working one lamp as it is for working 100 or 1,000 lamps. *Electricity is not conducted upon the conditions appertaining to a pipe conveying a ponderable fluid*, the resistance of which increases with the square of the velocity of flow." Sir W. Armstrong, in his address to the mechanical section of the British Association in 1881 says: "In the case of a fluid current through a pipe the resistance to the flow increases as the square of the velocity, while in the case of an electric current the resistance through a given conductor is a constant proportion of the energy transmitted. So far, therefore, as resistance is concerned, electricity has a great advantage over water for the transmission of power." So we may see that by converting mathematical formulæ, which are nothing but mental tools (apparatus for mechanical thinking in some sense), into actual facts and theories, electricians have actually been led into great errors as to the nature of the electric constants.

In these quotations we have two distinct statements—first, that in electricity a resistance is the same to all currents transmitted; second, the sentence italicised, that currents of electricity and currents of water depend on different laws. Most electricians then, and many of them now, would indorse those statements. I dealt with them at the time in the pages of the *Electrician* and the *English Mechanic*, and will now show clearly what is really the thing that is alike for large and small currents, and also that *water in pipes and electricity in wires are conducted upon identical conditions.*

4. The fundamental expression of *Ohm's laws* is $\frac{E}{R} = C$, which means force (or more correctly "potential") divided by resistance defines the current, or rate of flow.

It follows that any two of the three elements, E, R and C, being known, we can calculate the third thus, using the units of the B. A. system: the volt for E. M. F., the ohm for resistance R, and the ampere for current C.

Current.—$E \div R = C$. Force and resistance being known.

Electromotive Force.—$C \times R = E$. Current and resistance being known.

Resistance.—$E \div C = R$.

Energy$= C^2$, the square of current, in unit, or unaltered conductor, or $C^2 \times R$ as a general law.

5. The usual expression of the meaning of the formula is, *current is as the force and inversely as the resistance.* In order to fix the mind upon the ideas I wish to develop, I give this modified definition: *Current is as the E. M. F.* (which is *potential*), and *as the conducting capacity.* That which in the usual expression *is called resistance*, is simply the *reciprocal of the conducting capacity.* It has nothing to do with anything commonly known as resistance.

6. According to these relations, C varies as E, but energy, as work or heat, *which are the true resistance*, varies as E^2; that is as the square of either C the current, or E the E. M. F., in unit or any unaltered conductor, and it also varies as the so-called resistance; that is to say, it is inversely as the conducting capacity of circuits. This is precisely the ordinary law of mechanics, say in friction, where work absorbed is as the square of velocity, and directly as some other element, such as weight.

7. The very first point as to which a clear understanding is necessary is whether these symbols, E, R and C, have any realities behind them. Do they represent facts, and if so, what facts? Or are they merely mathematical expressions, simple tools of thought? If the latter, we must carefully avoid the error of mistaking them for facts, lest, like the monster Frankenstein, they prove too much for their creators. It will be more convenient to examine this while studying Ohm's formula as a whole, than to treat each head singly.

8. *Electromotive Force.*—Is the E. M. F. which we symbolize by E *a force?* Let us see what idea we can form of it. A force tending to set electricity in motion; or, to use a better phrase, to set up that motion which we call electricity. Here it will be seen we have two considerations presented to us: an effect, the motion produced; a cause, the force producing the motion. Of these the first, the motion, is of necessity an actual fact, though we may hold different ideas as to what is the thing. But does the *cause*—the *force*—exsit, that is to say, the special force? There are actual forces having real existence, such as the various attractions, of which we may take gravitation as the type; these are, so to speak, self-existent—we know not their causes. But there are other agencies which we call forces, yet which have no actual existence. They are

really transformations of energy, and are forces only in the mathematical sense.

9. *Development of E.M.F.*—When we dissolve zinc in a battery this force makes its appearance. It is said by some to be due to the contact of the two dissimilar metals. But one thing is certain—this force can do no work unless it is maintained by an equivalent supply of energy, and, as a matter of fact easily proved, the degree of electromotive force produced is measurable in terms of the energy transformed in its generation, which is measurable by the heat set free in the chemical combination.

But if we expose the junctions of two different metals to heat, we find electromotive force set up in degrees depending (1) upon some inherent property of the metals, and (2) upon the difference of temperature produced, which means, in fact, the quantity of energy which can be thrown into the circuit.

Similar results are found when we examine the E.M.F. set up by dynamo machines. It bears a definite relation to the energy expended. We find also that though electromotive force is constantly acting upon the circuit, it has no accelerating action. We therefore conclude that it has no actual existence, but is due to conversion of energy, and that it must in some way be equivalent to the energy which it expresses.

The effect of the ideas about to be presented is to show that E.M.F. is no occult effect of *contact*, or of cutting lines of force, etc.; that these are but "conditions;" that E.M F. (or potential) is always an expression for, a measure of the effort of energy (potential or kinetic) to take the kinetic form under any particular conditions.

10. *Any agency may be called a force* which is capable of setting up motion, or altering the conditions of motion in a mass of matter. Thus, if we take a ball of lead and let it fall, motion is imparted to it by gravitation. We may push the same ball of lead along a table, or by muscular energy hurl it to a distance. We may strike it as a cricket ball is put in motion, by a percussive blow; or we may, by aid of a gun, set it in motion by means of compressed air, or by the explosion of gunpowder. In all these cases motion is produced, and we may call the agency in each case a "force."

11. *Mechanico-Motive Force.*—We may embody all these in one expression, and say they are due to a "mechanico-motive force," the intensity of which can be measured by its capacity to produce momentum. Of course the object of this term is to obtain an exact mechanical counterpart to the electric expression, but this term or something like it, has actually been employed in mechanics. We have then to see whether this mechanical analogue is a force, or what is its true meaning.

12. *Static and Dynamic Force.*—There are two ways of treating and measuring a "force." (1) By the *pressure* it produces. This is a static action, and it measures a force as a *degree*, not as a quantity. A force so regarded is an abstract property or power; it has no relation to energy, because it does no work, though it has a relation to *potential energy*, as will be seen later. (2) By the motion it produces in matter, and this, again, has two aspects. 1. *Velocity*, which may be general or abstract, as in the case of the force of gravitation when expressed by the ordinary symbol *g*, meaning its capacity of generating a velocity of 32 2 ft. per second. 2. *Momentum*, in which the force becomes concrete and *quantitative* by the introduction of unit mass of matter, and unit time. But this is no longer true *force*, it is an expression of *energy*—of the work a force can do under unit conditions. The *dyne* is such a force, or, more truly, a mathematical expression for a unit quantity of force, and it is the same value, in reality, as the *erg*, the unit of energy. They are simply expressions for the two aspects, *cause* and *effect*, force and work, which of necessity are equal. This will, of course, be objected to by the mathematical minded; but this is a case where truly, "if the ideas are correct, it is of secondary importance what language is used to express them." The idea is an inevitable consequence of the conservation of energy. *Force expended and work done must be equal*, and the purpose of my statement as to their units, the dyne and erg, is just to impress that fact. The usual plan of regarding them as belonging to distinct orders is directed to another purpose—their practical application.

13. Gravitation as a natural force therefore produces (1) a static pressure (2) a velocity—say 32 feet per second—(3) a momentum in a mass—say 16 feet lbs. per second. It also produces acceleration, that is to say, acting continuously its effect is accumulative. This property would be important in a treatise on mechanics, but does not necessarily enter into the electric treatment of force; its effects are included in the actual velocity and momentum generated.

But it may be well to point out that the ordinary conception of gravitation, as due to the attraction of the earth for movable bodies, is misleading, because it leaves out of sight the part played by the second body itself. The effect of this is that while we can express a spring or steam force as a pressure of so many pounds per square inch, we cannot so express gravitation *per se*.

We shall deal with such a pressure presently as "head of water," but this is a compound expression. Besides the attraction of the earth it includes that of the water itself, that is, its own weight (or more properly mass.) Of course it is perfectly known that this attraction is really that of the two masses, earth and body; it is only the common way of thinking that I refer to, which reacts even upon science.

In our utter ignorance of the real cause of gravitation, we fix our ideas upon the mere masses of matter and satisfy ourselves with the statement that it is

$$\frac{M \times M^1}{D^2}$$

and in that formula we bury away the agency itself, the most perfect representation we can find in nature of an omnipresent consciousness.

14. We wind up a spring, and we know we have stored our work in it. We wind up a weight and we know we have stored our work in it. We speak of "potential energy" in both cases, but in how different a matter do we think of the two agencies of storage. One seems real and the other mythical; the one we call energy of stress, molecular strain; the other we call energy of position. But let us conceive a powerful spiral spring attached to a rope passing over a pulley, and thence to a winch by which the spring can be strained or wound up. We have here a tangible agent to deal with. We see the strained spring and we know that the spring, by virtue of that strain, will return us our energy by doing work equivalent to that employed in generating the molecular stress. But we replace the spring by a mere weight which we wind up, and then we talk of energy of position. It should be clearly realized that the two conditions are identical; in winding up the weight we have in some way, wholly unknown to us, put a stress upon the earth and stored energy just as certainly as in the spring. We do not know how, but in some way the force of gravitation is as surely an expression of energy stored up in matter as is the attraction exerted between two charged electric surfaces across the strained dielectric, which is expressed by the same formula,

$$\frac{Q \times Q^1}{d^2}$$

and by the equivalent magnetic law, all these so-called quantities being, in fact simply measures of the stresses or attractions exerted by forces.—*London Electrician.*

Theoretical and Practical Consideration of the Phenomena of Electro-Magnetic Induction.

By Gourant de Trommelin.

The author sets out with the following theorem:

If a finite conductor is in motion in a uniformly magnetic field, the quantity of electricity which is thereby set in motion and developed by the induction to which the body is subject during its movement is equal to the surface, S, which encloses the projection of the conductor upon a plane vertical to the lines of force of the magnetic field, multiplied by the ratio of the magnetic field, H, to the total resistance of the circuit, R.

Electric Illumination in San Francisco.

THE EDISON INCANDESCENT LIGHT FOR WHARF PURPOSES.

The Oregon Steamship Company have received from New York engines and machinery for the erection of the Edison incandescent light on their wharf at Spear street. The machinery is being put in place and consists of three dynamo generators—one double and two single. The generators, when in motion, will produce 240 lights for the wharf of sixteen candle-power each, and will each make 1,200 revolutions a minute. The double one has a capacity of 120 lights, and the single ones of 60 each, making 240 in all. The dynamos will be run by two independent engines of twenty-horse power each, supplied by two vertical boilers five feet in diameter and eight feet high, with steam-drum eight feet in length and three feet in diameter. The machinery is so arranged that the wharf can be lighted on either end by itself, and is so fixed by combinations, by four separate lines, that either line can be used and the lamps lighted without interfering with the others. The switchboard contains seventy-five different keys, which are independent of each other. The work will be completed in about one week, when an exhibition of the light will be given to the public.

A Visit to the Works of the Brush Electric Light Company at the Lower Falls, Rochester.

Early in the spring a description of the large wheel pit, excavated by the Brush Electric Light Company at the Lower Falls, for the purpose of obtaining unlimited power for the manufacture of electricity, was published. Since that time the large machinery has been placed in the pit, and the new brick building erected just below the brink of the falls, by Joseph Cowles. A few days ago a few representatives of the daily press of this city accepted an invitation of Manager George A. Redman to visit the works. After inspecting the electric apparatus on the first floor, they clad themselves in rubber habiliments, and forming themselves in Indian file, V. Finzer, Mr. Cowles' foreman, acting as guide, and Mr. Redman bringing up the rear to see that no newspaper man should escape, and bidding farewell to daylight and several workmen standing by with significant smiles on their faces, they descended into the great pit. The dim rays from the lantern carried by the guide assisted the reporters in making sure their trembling steps. The impressions of the finger nails of some of the party are said to be easily seen upon the ladders by which the descent was made. After dodging a number of ponderous wheels, whose rapid revolutions produced a small cyclone in the pit, they at last reached the bottom, directly under the falls. Here one of the most beautiful views of the Lower Falls was obtained. A visit was then made to the tunnel, about sixty feet long, which is being made in solid rock to make connections with a new wheel pit now in process of construction. A salt spring is said to have been found, but the newspaper men did not seem inclined to sample the saline goods. While they were admiring the falls and adjacent scenery, two or three were seen to duck their heads, for two or three large stones passed within a few feet of the place where they were standing. At first some thought the entire ledge of rocks above was about to be precipitated upon them, and they made a rush for the entrance of the wheel pit. The incipient panic was, however, soon checked by Mr. Finzer, who said that this was a signal to stop work, as it was six o'clock. No one seemed to care to wait for any more signals, and the ascent was begun, a newspaper man this time leading the way. An attempt was made to count the ladders and stairs, but either figures or his wind gave out, and the attempt was necessarily abandoned. He, however, was informed later that there were six ladders and four flights of stairs. Nothing happened in the ascent except that one of the reporters took a wrong ladder, and before he knew it his head and cheek collided with the side of the pit. Some claim that the rock was considerably shattered. He retraced his steps, gave warning to his followers and began over. Once more on the surface of this mundane sphere they heaved a sigh of relief as it were, and cast aside their rubber garments, which the facetious newspaper men said were something of a compromise between the dress of Paul Boyton and a canal-boat steersman.

In the bottom of the pit there are two twenty-inch Victor water-wheels each one possessing 572 horse-power. Only one of them is in use at the present time. They have a bulkhead of ninety-four feet, and make 582 revolutions per minute. This is believed to be the fastest speed of any similar wheel in the world. The upright shaft in the pit is sixty feet long and six inches in diameter. Upon this shaft are two spur wheels, six feet and seven inches in diameter, one weighing 6,000 pounds and the other 4,800. These make 183 revolutions, the highest speed ever acquired for such immense wheels. Another interesting feature is the endless rubber belt connecting a ten-foot pulley with the machinery on the first floor. It is fifty-four inches wide and weighs 600 pounds, thus being the largest belt in the world. It travels 5,900 feet or over a mile per minute. On the first floor is a three inch shaft, upon which are to be placed nineteen taper-sleeve dead pulleys. Each pulley will be connected with as many dynamo machines. Only one machine is, however, now running, but others will be moved in immediately, the work beginning to-day. If found necessary thirty of those machines can be put in. The shafting on the upper floor makes three hundred and fifty revolutions per minute. Each machine has a governor to relieve the magnets at any time when it becomes necessary. A switch-board has been put on so as to transfer any machine to any circuit. The company has at present 240 lights throughout the city. They have power at present sufficient to run 1,150 lights. The one machine now working furnishes light on the circuit used during the daytime. The night lights are furnished by dynamos in various parts of the city. These, however, as stated above, will be removed to the building at the Lower Falls. When the new wheel pit which is now being sunk is completed, two thirty-inch water wheels of 700 horse-power will be placed in position. This will furnish almost unlimited power for the Brush electric light company.

The above description can only give a faint idea of the extensive works for manufacturing electricity that are being constructed in our city. Everything is being done in a first-class manner, without regard to the necessary expense The machinery has been put in with great skill and labor, and reflects great credit upon the machinist having it in charge. It should be stated before closing that Mr. Redman spared no pains to make the trip not only enjoyable but instructive, and all who had the pleasure of making the trip with him are unanimous in their thanks to him and to Mr. Cowles for their substantial entertainment.

The city electrician of Chicago has declared war against certain electric light companies by cutting wires not placed under the ground. Competition has become so sharp between companies that it is claimed they do not use proper insulated wires, and string them at random on house-tops, which would result in instantaneous death to any one touching them. A number of wires have already been cut. This action has reference to arc lights only, no danger being apprehended from wires used for the transmission of currents for incandescent lighting.

Telephonic.

News from the Northwest.

As a commercial mart and important business center, the city of Minneapolis has been paraded by the press of the country. The growth of the city has been phenomenal, and although business of all kinds has accumulated and thriven through a healthy growth, the lack of the public has been a reliable working and creditable telephone exchange system.

As a telephone field there is no better territory than the city of Minneapolis, and through the efforts of the present controlling company improvements and radical changes are being brought about with a view of placing the system before its patrons at its best where prompt, reliable and efficient service can be obtained. It is estimated that $30,000 has been expended during the last four months in city line construction and reconstruction.

Five switch-boards of the multiple or duplicate pattern have been introduced in the operating room—devised by the associates of the Western Electric Manufacturing Company of Chicago.

The essential feature of this board is the arrangement of the wires in such a manner that each operator while having but fifty lines that are her special care, has upon the same board with available connection a loop from all other lines centering in the office. This supplants the old check system or plan of signalling through the boards for desired connections.

At present the exchange has in the vicinity of 850 subscribers, with an estimated city population of 100,000 people, with better facilities and a radical improvement it can readily be seen what the future of the telephone is to be in Minneapolis.

The Erie Telegraph and Telephone Company, controlling at present in their Northwestern division all of Minnesota excepting Brookston and Duluth, all of Dakota excepting Deadwood and Jamestown, likewise part of Wisconsin, have during July established exchanges at Mankato and St. Cloud, Minn., and Bismarck, the new capitol of Dakota, besides acquiring July 1 the right of the Southeastern Dakota Telephone and Telegraph Company. Covering exchanges at Yankton, Huron, Pierre, Sioux City, Pierre and Watertown. In all, placing over 2,500 subscribers under their control in exchanges rapidly increasing in number of users.

Telephone Patent.

Mr. I. H. Farnham, Superintendent of the Portland Division of the Telephone Company, has just received letters patent on "telephone system and apparatus" containing nine claims. The apparatus was devised particularly for this exchange to overcome difficulties that arise in most large exchanges, of passing the connection through a number of operators before completed or making the switch apparatus cumbersome.

ST. PETERSBURG, RUSSIA,
C.-TLEMEPOYPER July 1st, 1883.

Editor Electrical Review:

I take this opportunity of letting you know how the telephone business goes in Russia.

We have been working here about fifteen months, and have now about 500 subscribers connected and about 1,400 versts of wire and supports.

We have also in Moscow 290 connected; Warsaw, 300 connected; Odessa, 240 connected; Riga, 182 connected; Ludz, work just beginning.

These results, considering the state of the country, are very gratifying, and great success for the business predicted.

Our staff is composed of Americans and Englishmen, and they deserve great credit for their perseverance and industry, as well as their ability as constructors and electricians.

It was confidently expected that the coronation would give business a "boom," but the contrary seems to be the result.

Long lines will hardly be attempted here; first, because towns are too distant from each other; and second, because the Government, who run the telegraph business here, would suffer loss, or demand too high a sum for the privilege.

We have, however, connected Gatchino Palace (44 versts) and Peterhof Palace (36 versts) with this city, and the lines work splendidly and are much used.

Our system is "Gilliland," and our construction altogether on iron supports and wooden poles.

Yours truly,
JOHN CRAWFORD,
Chief Engineer.

Our friend Smith says the best switch in the whole telephone business is the one you can't touch without making the girl who wears the other one mad.

Telephone Consolidation.

LOWELL, Mass., August 1.—The basis of the consolidation of the New England telephone companies has virtually been agreed upon. The American Bell Company, holding one-half of the stock, $8,000,000, the balance of the $16,000,000 will represent the property, except $1,000,000 held in the treasury for construction. It is believed that the business will be completed by August 15th

It is stated that telephone receptions are growing popular in the West. Ah! Somebody will be telling you of a telephone tea-party, but don't you believe it—at least, not as long as the telephone is made so that only one person can talk at once.

A native employed as lineman by the Mexican Telephone Company received a severe fall from a pole a few days since. He has been well taken care of by the company, and is now well on the road to recovery, thanks to the kind treatment received at the hands of his employers, who never lose an opportunity of showing kindness toward their employes.—*Two Republics.*

The telephone system of Oaxaca, Mexico, has been established under the most favorable auspices. The central office is fitted up in elegant style, and has the latest modern improvements common to large cities. The service, so says the official paper of the State of Oaxaca, is efficient, and the employes are on the alert to repair any "interruption" that may occur. The system is under the management of Mr. A. G. Haines.

BROWN—Had a terrible accident down at the sewing s'ci'ty last night.

SMITH—Did, hey. What was it?

BROWN—They met down at Scroggins'. Minister has just put in a telephone on same circuit, and when he called up pretty Widow Softhead down street, six girls, two men, and twenty-seven old women was nearly crushed to death tryin' to hear what the dominie said.

SMITH—Don't say. Is that all?

BROWN—No; Mrs. S. got hold of the receiver first. But excuse me, Smith, there goes Coroner Mycase to hold the inquest.

Telephone Talk.

SOME OF THE IMPROVEMENTS TO BE MADE—A TALK WITH MANAGER FOWLER.

Considerable comment was caused on the streets of Memphis, July 20th, by rumors that a general advance was soon to be made in telephone rates; that the yearly rental, which is now fifty dollars per year, was to be increased to sixty-five dollars, or perhaps more. An *Appeal* reporter, in order to learn the facts in the case, called upon Mr. Fowler, the Memphis manager for the new company, who stated that the rumors were without foundation. Mr. Fowler said there will be a general revision of the rates about September 1st; that there would be no general advance, but rather an equitable equalization. For instance, the rate for a dwelling-house, where the telephone is not used on an average more than two or three times a day, and which now pays the same as a hotel, where it is used from two hundred to three hundred times, would be reduced, while the rate for hotels or public buildings might be slightly increased, but not enough to make any material difference. Mr. Fowler also stated that the company were making a number of valuable improvements, replacing worn-out batteries, &c., and that cables had already been ordered to replace the network of wires at the corner of Madison street and other public places where their constantly increasing number renders them not only an unsightly nuisance, but dangerous in case of fires. Linemen left last night for Nashville, to procure the outfit for the line between here and Brownsville, and the other lines will be constructed as rapidly as possible. An office and outfit, to cost three thousand dollars, is already on the way.

The Mexican *Financier* says: "Mexico now has a net-work of over 15,000 kilometres of telegraph lines, which, with the construction of the railways, is rapidly increasing. Beside this, a large system of telephone lines has been created. The opportunity which is thus afforded for the prompt and extensive collection of news from all parts of the country has not yet been taken advantage of by the press of this city, probably because no one has yet taken the initiative. The time is ripe for action in the matter. Arrangements could easily be made with the Federal Government and with the railway companies for the use of the wires at reduced rates, and a complete news system for the entire country could thus be built up in a short time without difficulty. The Mexican press would find no surer way to increase their circulation, their influence and their prosperity than by uniting in this matter. A great transformation is to come over the country with the completion of the railways, and one element of this transformation is to be the wide circulation of the metropolitan press—whose influence and the reading public have hitherto been exclusively confined to this city and its immediate vicinity—through all parts of the republic.

Telephone Business in Pittsburg, Pa.

"It is pretty near time to look out for another movement in the telephone business," remarked a gentleman to a *Commercial-Gazette* reporter yesterday.

"What's coming next?" was asked.

"Well, you see, all the New England telephone companies have consolidated, with a capitalization of $15,000,000, and I expect soon to see a similar movement set on foot here as well as elsewhere. It will probably be the policy to consolidate all the different companies in a large State like Pennsylvania, though it is just possible the reorganization here may also include Ohio. Each of the new companies will have a superintendent at a central point of its district, and the cost of management will be reduced and such other economies introduced as must tend to a considerable increase in the net earnings. All the companies in Iowa have already been consolidated, and I shouldn't wonder if we would come next in order."

"Is there anything else new in regard to the telephone business?"

"Nothing special, except that the strike of the telegraph operators has once more called special attention to the great possibilities of the telephone system, where skilled operators are not required. Long distance telephoning has already been demonstrated to be perfectly practicable. I myself have talked over the wires of the Postal Telegraph Company from New York to Chicago, and could make myself understood and receive satisfactory replies. The system, of course, is not yet brought to perfection, but it will be. They are now working on a long distance telephone which gives every promise of complete success. It is all a matter of complete adjustment of the strength of the battery. With the system in good shape and telephone lines to the Eastern cities, difficulties like the present would be entirely obviated."

The gentleman concluded by saying that such a consolidation as that spoken of above would give telephone stock such a boom as would make present prices look dirt cheap.

Tales of the Tickers.

Some of the operators now at the wires are a little rusty. They have the theory, but are out of practice. Yesterday a superintendent and a manager undertook to converse over the wires. "I've got business with you," clicked the manager. "I—I—I—I. Go ahead, frite stow," came the answer. "Write slow" was meant; t and l are both dashes, t being short. Inexperienced operators get p and h mixed. P is five dots and h four. An Evansville operator asked who was at this end of the line, and Manager Butler, who recognized an old acquaintance, said he was. The answer came, "Papa, go ahead," which was finally interrupted as "Ha! ha! go ahead!"—*Indianopolis Journal.*

Telephone Stock Quotations.

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Bay State Telephone Company	133
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Mexican Telephone Company	2½
National Bell Telephone Company of Maine	84½
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Northwestern Telephone Company	100
Southwestern Telephone Company	68
Suburban Telephone Company	139
Southern Bell Telephone and Telegraph Company	125
Tropical Telephone Company	8
Central Union Telephone Company	110
Iowa Union " "	100
Missouri and Kansas Telephone Co.	100
United Telephone Company (Kansas and Missouri)	95
Bell Telephone Company, of Missouri	165
Wisconsin Telephone Company	125
Cumberland Telephone Company	105
Great Southern Telephone Company	100

Telephone Companies Uniting.

LOWELL, Mass, August 4.—At a meeting of the directors of the National Bell Telephone Company, of Boston, and of the Suburban and Bay State companies this morning, resolutions were adopted recommending a consolidation upon a basis substantially as follows: Capital of the consolidated company, $16,000,000; Boston and Northern stock goes in at $150 per share; Bay State at $130; Suburban at $140; Bell National of Maine at $90. The American Bell Company will hold $8,000,000 of the consolidated stock, and will waive a dividend for three years, after which $1,000,000 will participate in the dividends. There will be $8,000,000 new issued stock and $200,000 in the treasury for construction. The Southern New England Company will represent in the consolidation $1,673,000; the Southern Massachusetts Company, $711,000; the Providence Company, $800,000, and the Granite State $121,500. Morris F. Tyler, of connecticut was proposed for president, W. A. Ingham for vice-president, some Boston man for treasurer, C. J. Gliddon for secretary, L. N. Downs for general manager for the Northern division, and H. P. Frost for the Southern division.

Electrical Accumulator.

BY H. MULLER.

A quadrangular trough, lined at the bottom with slag-wool or asbestos, is divided into two compartments by a horizontal diaphragm of parchment paper, unglazed porcelain, &c, bent in a zig-zag manner. These compartments are filled with a mixture of coke and litharge or red lead. Two plates of coke or lead, fixed on the sides of the trough, serve as electrodes.

Telegraphic.

Automatic Printing of Telephotic Dispatches or those Transmitted by Light.

By M. Martin de Brettes.

Every printing apparatus, in order to act, requires the mechanical work of a force which is manifested to the purpose, that is to say, when and how the sender of the dispatches wishes.

This small force is required for the magnetization of an electro-magnet, and the mechanical work serves for the attraction of the keeper, the movement of which determines the action of the apparatus.

In order to solve the problem of printing telephotic dispatches at the receiving station, the light projected must have the power of producing there, during its continuance, which depends on the will of the sender, the magnetization of an electro-magnet, forming part of a local battery, or an augmentation sufficient for it to overcome the opposing spring of its keeper.

The illuminated part of the circuit of the battery must consequently be composed of a body endowed with the property of becoming suddenly conductive under the influence of light, and of ceasing to be so when the light is withdrawn. There exists, as is known, a body which possesses this property in a very high degree, namely, selenium.

The electric light produced at the receiving station in a Mangin's projector is sent there as a bundle of parallel rays, and received upon a converging lens, at the focus of which is fixed the selenium element forming part of the circuit of the local battery, which contains the coil of the electro-magnet moving the receiver.

The impression of the jets of light in black marks, long and short, according to the Morse alphabet, is made with the Morse apparatus. The jets of light are transmitted by the movement of a simple lever which displaces a screen. The printing of the dispatches in ordinary type is effected by means of a Breguet frame receiver, the needle of which is replaced by a type wheel, and to which is added a printing mechanism, which acts by means of a special battery, and only when it is wished to print some given letter.

The distance between two stations depends on the transparency of the air, on the latitude, and, all other things being equal, on the quantity of light received per unit of surface when the luminous rays are parallel. The law of the decrease of the intensity of light in this case is not known; but it depends solely on atmospheric absorption, for in a vacuum the intensity would remain constant. We cannot determine *a priori* the distance of the two stations for a given electrical focus; recourse must be had to experience.

The fine experiment of M. Fizeau for determining the speed of light shows that the distance of two stations might be consider able with the modern powerful electric lights which exceed 2,000 carcels.

We know, in fact, that in these experiments the light of a lamp gave, after a course of seventeen kilometers, a brilliant focus of very appreciable intensity.—*Comptes Rendus.*

A New Telegraph Company.

The certificate of incorporation of the Exchange Telegraph Company was filed in the County Clerk's office Tuesday last. The incorporators of the company are Stephen D. Field, of Yonkers; Charles S. Hurd, of No. 176 Madison avenue; Alexander Thain; of No. 62 East Ninety-first street; J. Bentley Squier, of No. 21 East Seventy-ninth street, and James C. Jewett, of No. 27 William street. The general route of the telegraph line of the company is to be from this city to San Francisco, with intermediate lines and branches as required. Its capital stock is $2,000,000, divided into 20,000 shares of $100 each. The right to increase this capital is reserved. Each of the corporators has one share of stock. Alexander Thain, a lawyer, of 62 East Ninety-first street, said last evening that a prospectus of the company's plans would be issued in a few days, and that $250,000 had already been pledged by merchants, especially by persons in the grain business. At first the company would run wires to Chicago, and these were expected to be in operation by Jan. 1. Some of the best telegraphic patents in the country had been secured, and a new system would be used for sending a large number of messages on the same wire in different directions. Mr. Thain said the company intended to build the line and operate it as a business enterprise, and that it was not for sale.

Advertising by Telegraph!

A NEW WRINKLE JUST ADOPTED BY OUR COUSINS ACROSS THE OCEAN.

A London letter says: Now that it has been decided that we are to have a sixpenny telegram rate there is every probability of there being an enormous increase of business in the department. To give some idea of the increased number of dispatches which will be sent I may just mention that one firm alone have announced their intention of sending out 50,000 telegrams by way of advertisement the first day the sixpenny rate comes into operation. The use of the telegraph for advertising purposes is apt to degenerate into a nuisance sometimes. Even now, with the shilling rate, many firms use the wires for bringing their goods under your notice. A telegram is associated with urgency, and when one of these advertising dispatches came to my house the other day, and a special messenger was sent chasing me all over London with the assumed-to-be important message, I was not particularly delighted to find that the dispatch emanated from some patent medicine vendors. I will not give their names, for I am still too mad to give them the slightest gratuitous advertisement if I can help it. The dispatch ran: "As you value your life, send for a bottle of —— immediately." My special messenger and the cabs in which he had followed me round London cost me nearly a sovereign, so perhaps it is not necessary to add that I didn't feel inclined to waste any more money over Mr. Blank's precious potion. A friend of mine living in a large provincial town lately received a dispatch worded something like the following: "Be sure to come and see 'Caroline' to-night at 8." My friend was from home when the message arrived, but his wife opened and read it, and he assures me that it took a good deal of explaining to make her properly understand that "Caroline" was the name of a play, and the message was one of half a hundred sent out by the theater manager to the members of the town council.

A Funny Mistake.

Telegraphic anecdotes being in order reminds us of a dispatch which some years ago a business man in this city sent to his correspondent in New York, requesting him to have a room reserved for him at the hotel, as he should come on that afternoon.

Arrived late at night he stood serenely behind the crowd at the old Astor House, who were registering their names, even till the clerk began to turn applicants away for lack of room—assured that his despatch in advance must have secured accommodation, but was surprised and indignant to find that no order for a room had been received, and was obliged to hunt up lodgings for the night elsewhere.

Early next morning, in response to the demand if his dispatch had been received, his correspondent replied in the affirmative, and that a store-house had been hired for him in Beaver street as ordered.

"A store-house! I never ordered a store-house."

The dispatch was produced. It read: "Shall be on to-night; have room in a store-house secured at once."

Application at the telegraph office revealed the fact that the young woman who received the message as it came slowly from the wire supposed the operator had been abbreviating and she therefore corrected (?) the spelling of the message, which originally read: "Have room in Astor House secured at once." The division of A-stor and addition of an e produced quite a different result than was desired.—*Boston Commercial Bulletin.*

Humor of the Strike.

About 11 o'clock this morning an old man of about 70 years, arrayed in a faded duster and clutching a gripsack in his hand, entered the Secretary's office in the Western Union building. He deposited his gripsack on a chair, and, after placing his ancient headgear on a table, remarked to one of the clerks:

"I heerd there wus a strike and that youse fellows wus in need of men. I live over in Jersey, and I've been misfortunate, and I thought I'd jist come over here to work."

"Have you ever been in the telegraph business?" inquired the amused clerk.

"No, to tell the hull honest truth, I never was. But I'm kinder handy, I am, and can pick anything up right quick. I guess I can learn all about the telegraph in two or three days. Say, boss, do you think I kin ketch on?"

The clerk blandly replied that he did not think there was "a ketch" for the old man. The company had engaged enough men already.

"Just my luck," exclaimed the old man, as he took his departure.

Getting His Money's Worth.

A man, a little top-heavy, rushed into a New York telegraph office, seized a telegraph blank and a stub pen with a ball of dried ink on the end, and, by propping himself against the counter, managed to write the following message:

Kate: I won't be home till morning.

Harry.

"What'll that cost?" said the man, handing the message through the porthole to the manipulator of electricity.

"Let me see. Seven words—fifteen cents."

"Fifteen, eh! How much for ten words?"

"The same price. Anything not exceeding ten will cost you fifteen cents to any address in this city," answers the operator, making a spring to muzzle an instrument that was sputtering as if it had delirium tremens.

"I am bound to have the worth of my money out of your corporation, then," said the man, bracing himself against the counter as he traced on a blank this clear message:

Incomprehensibility, manufacturers, transcendentalism, Constantinople, concavoconvex, Massachusetts, assassination, Pennsylvania, imperturbability, philoprogenitiveness.

"There, string that on your wire, and send her at a 2:40 gait," said the man, with a look of vengeance in his eye.

The operator counted the words, but volunteered the information that there was no sense in the message, and that the dictionary must have been ransacked for the longest words.

"I know there's no sense in it, but Kate will understand it all the same. She'll know I'm on a drunk anyway when I send a message at this hour, whether it's sense or not. I made 'em long on purpose to break the back of your darned machine. Shovel 'em in and start the crank. I'm in for a good time. Never mind the expense. Here's your fifteen cents." And the man ran out and hailed a passing cab.

Electric Lamps as Fly Catchers.

"These electric light globes are regular fly catchers," said a young man who was putting in new carbons in a lamp in front of Andrews Brothers' store la t evening. He emptied more than a pint of dead flies, millers and bugs that had collected the night before. The same operation was repeated at the other lamps.—*Syracuse Herald.*

The District Telegraph Boy.

What is this?

This is a district telegraph boy.

But what is a district telegraph boy?

He is a boy who appears at your door twenty minutes after you fool with a little box which says "br-r-r-r."

Oh! he is the boy who takes messages.

Yes, darling; he takes messages.

But this boy has no message?

Yes, he has, dear.

What is it?

It is an urgent appeal for the doctor to come right away to a man who is dying.

My! but why doesn't the boy hurry?

He is hurrying.

He is hurrying to do what?

To count the marbles exhibited in that window.

And when he has counted the marbles, will he go?

Certainly, dear.

Where?

To the next window.

And then?

To the next.

Gracious! how far is it to the doctor's?

Seven blocks,

How long will it take the boy to get there?

About three hours.

Goodness! the poor sick man may die before the doctor comes,

He probably will, sweet.

Well, is not the poor district messenger boy to blame?

No, precious.

Who are to blame, then?

The sick man's friends.

How?

They should have gone for the doctor themselves.

And what will they do now?

They will go for the boy.

And what will he do?

He will say he was "detained."

And what is that?

A lie.

But suppose you are in a very great hurry?

Yes, dear.

And you ring for a boy?

Certainly, darling.

And he comes.

Exactly, my precious.

And it is dreadfully important that your message should go to its destination on time.

Of course, sweet.

Is there no means by which you can be certain of its prompt delivery?

Oh, yes.

I'm so glad. How?

Take it yourself.—*Life.*

The city electrician, Professor Barrett, reports the electric light companies all coming into line and properly insulating their wires. "They are taking down all lines that cross streets and burrowing under ground with them, I guess," said he, laughing. "They show a disposition to do the right thing, and I am satisfied that the nuisance and the danger will be done away with entirely in a few days."

Men Who Never Strike.

Perhaps the most law-abiding and patient persons in the world are the newspaper writers. Newspaper writers never strike. The intelligent compositors may rise in wrath, but the newspaper writer quietly pushes his pencil, trusting in Providence and his proprietor, and hoping for better times. Be his salary ten dollars or forty dollars, it is all the same. Sometimes he "severs his connection," and sometimes, when discharged, he "resigns," but he never strikes. The business of the country has never been disturbed by him, and though he and his proprietor often disagree as to how a newspaper should be managed, he ever gracefully yields his own opinions, and his politeness to the secretary and treasurer is a lesson in civilization. The country little knows how much it owes to the newspaper writer.

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We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Those desiring to recommend their goods can do so to any extent in our advertising columns, but we will not publish for pay anything of that nature in our reading columns.

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Electric Locomotion.

In the columns of our esteemed contemporary, *The Railway Review*, appeared recently an interesting editorial on "Electric Locomotion," and were it not that the writer, under a misapprehension of the facts in the case, inclines to a somewhat gloomy view of the subject, we should not hesitate to call it instructive as well.

The writer has collected what he evidently believes to be all the data bearing upon electrical locomotion up to the present time, and with this to work from as a base he finds that the steam-engine is not likely to be superseded, at least for the present.

This system of conceding only that which has been absolutely demonstrated is popular among practical men, and has much to commend it. We have no fault to find with the writer because he insists upon looking at things as they are, and not as they may be in the future. But we regret that he did not look a little deeper into what has already been accomplished before essaying to draw conclusions therefrom. "If electricity," he says, "could be produced directly from the heat energy latent in the fuel, without the intervention of steam as a medium of conveying the energy and wasting an enormous portion of it; or, if the storage batteries were an economical success, and could be charged by water or wind-power, then electric locomotion would have a different aspect. But neither of these two things have been done. Both are possibilities, not being in contradiction to physical laws, but they scarcely come under the heading of probabilities, at least during this century."

The readers of the ELECTRICAL REVIEW will see from this that the writer has left out of his calculations the most important application of electricity to motors that has yet been made, viz.: by means of transmission. Nor does he do full justice to the railway through the Giant's Causway in Ireland. When discussing economical successes, the generation of steam through the combustion of coal should never be alluded to. It were difficult to find anything less economical. Fifteen per cent. of the theoretical power of coal is all that is recovered in the steam-engines, whilst in dynamo-electric machines sometimes as much as 85 per cent. of the power applied to the first is recovered in the second.

Though we have great confidence in the storage battery, especially when applied to locomotion, we would inform the writer of the article in question that, if there was not such a contrivance known as a storage battery, the project of electrical locomotion would be but little affected. The most economical mode yet discovered of supplying the driving-wheel of an electric motor with energy is by the transmission of electrical power along an iron rail, whereby from stations established along the line of the road, this rail is kept constantly charged.

Now, if the electrical power sent from these stations is collected from running streams or by the utilization of the vertical rise and fall of the tide, or the lateral power generated by the currents, it must needs be very cheap, for such power would, if not turned into electrical energy, run to waste.

We will adhere strictly to the system followed by the writer in the *Railway Review*, and only speak of work accomplished. Following this we may fairly say that these electrical stations may be twenty miles apart, for M. Deprez, in his public experiments in the workshops of the *Chemin de Fer du Nord*, transmitted large quantities of power 21⅛ miles.

Again, we think the writer in question has, no doubt unintentionally, failed to give full credit to the efficiency of the storage batteries. He seems to believe that these may not be charged with energy by water or wind power, whereas nothing is easier when the appliances are at hand.

Arrangements are now being made to run electrical motors in various parts of the world, because, where thus far put to the test, they have behaved admirably. We do not wish to be understood as saying that these motors, which are being run by electricity generated by steam, are more economical than the steam engine; for, though many have insisted that such is the case, we have as yet by no means satisfied ourselves of the fact, but it will not be long before the discovery of Deprez will be put into practical use, and the great rivers, as they run onward to the sea, will, with but a tithe of their power, force electrical motors back and forward in the regions through which they flow.

Thus, as will be seen, it is not at all unlikely that at no distant day electricity will be substituted for steam in land locomotion. By this we do not mean that all the locomotives now running through the country will be sold for old iron. By no means. They will, doubtless, be permitted to run out their little day. But we think it not impossible that, as they become worn out with use, they will be replaced with electric motors, either of the independent type, worked by storage batteries, or by electricity supplied by means of a third rail.

Future Pyrotechnic Displays.

Aside from the strictly commercial possibilities of electrical applications there are some curious results that may not unreasonably be expected from the recent discoveries in electrical science.

The Chinese have justly been celebrated for the grandeur of their pyrotechnical displays. But the startling effect these displays produced upon European eyes and ears when first revealed may in the future be equalled or even excelled by electricity instead of niter, sulphur and charcoal.

Barrow in his "Travels in China" notices particularly the brilliant pyrotechnic exhibitions and describes pieces unknown in Europe. One of striking effect was the descent from a box suspended at an elevation of fifty or sixty feet of strings of lanterns, which gradually unfolded themselves to the number of fully five hundred, each one having a light of beautifully colored flame burning within it. From other boxes at the sides descended at the same time an immense network of fire divided into regular figures of the greatest diversity of form and colors flashing in great splendor and constantly changing. "The whole concluded with a volcano a general explosion and discharge of suns and stars, squibs, crackers, rockets and grenadoes which involved the gardens for about an hour in a cloud of intolerable smoke."

This was all very fine, and Barrow was very justly surprised at such an exhibition, for at the time he wrote electrical science had not reached the point of development it has since attained. But thunder, it may be said, is now grown a common drug among the chemists; lightning may be bought by the pound, and if one has occasion for a lambent flame, he may have whole sheets of it in a handful of phosphorus.

Imagine the grandeur of the spectacle that might now be presented from a captive balloon, say at an altitude of one thousand feet, by means of the electricity sent up to it from the earth, or from a balloon sailing through the air and loaded with secondary batteries. The heavens might be made to seem hung with blazing lights. Images of fire might be made to hang suspended in the air, and blazing chariots with prancing steeds scale the clouds—for the secondary battery will furnish motive power as well as light.

Strada relates that a prince of Italy thus represented a volcano upon a great lake. In the middle of this lake was a huge floating mountain, made by art. The mountain represented Ætna, being bored through the top with a monstrous orifice. Upon the signal being given, the eruption began. Fire and smoke, mixed with several unusual prodigies and figures, made their appearance for some time. On a sudden there was heard a dreadful rumbling noise within the entrails of the machine, after which the mountain burst and discovered a vast cavity in that side which faced the prince and his court. Within this hollow was Vulcan's shop, full of fire and clock-work. A column of blue flames issued out incessantly from the forge. Vulcan was employed in hammering out thunderbolts, that every now and then flew up from the anvil with dreadful cracks and flashes. Venus stood by him in a figure of the brightest fire, with numberless Cupids on all sides of her, that shot out volleys of burning arrows. Before her was an altar, with hearts of fire flaming in it.

This, of course, is fiction, being doubtless intended to amuse the curious and startle the credulous; but, if not to-day, at least in the not distant future, all this might be done through the interposition of electricity. The thunderbolts hammered out by Vulcan should be real thunderbolts, and the flashes, instead of being sulphurous fumes, should be real lightning.

Imagine the sublime effect of a representation, by means of electricity, of a scene out of Milton. An electrical contrivance could be made to represent the Pandemonium, where—

> From the arched roof,
> Pendent by subtle magic, many a row
> Of starry lamps, and blazing cressets, fed
> With naphtha and asphaltus, yielded light,
> As from a sky.

Electro-Mania.

Electrical science has proved a rich field alike for imposition and delusion. In the belief that electricity was a fluid, Muschenbrock, Kleist and Cuneus attempted to bottle it, and in the course of their experiments to this end stumbled upon the Leyden jar. The former of these experimenters took a slight shock and made up his mind that he had had a narrow escape from death. Writing to his friend Réaumur, he described the terrible effects of this shock, which from his description could not have been nearly as powerful as that which the itinerant "shockist" vends to the natives at country fairs. He said that it all but paralyzed his limbs and stopped the beating of his heart.

"Nor would I," he said, "take another such shock for the kingdom of France."

After Galvani and Volta had made their discoveries, Aldini, the nephew of the former, demonstrated that through the agency of electricity dead animals might be made to show all the symptoms of life, not only by means of the Voltaic pile, but also by a mysterious transfer of the agency from one animal to another.

With this as a base, the itinerant quack constructed the most absurd theories, and, by reason of the superstition which is said to go hand in hand with human ignorance, began a career of imposition which knew no bounds. With a prepared frog, which was the galvanometer of the period, he performed what, in the eyes of his open-mouthed auditors, was a series of wonders, if not miracles. Connecting the nerve and muscle of the frog to the nerve and muscle of the dead ox, its limbs were observed to kick, its eyes to roll and its body to assume the appearance of life-like animation.

Even in the present day we read the dogma, then established by these quacks, that electricity is life, though the power of restoring the dead to life which they then claimed, has ceased to find believers even among those the most ignorant.

But in the time of which we speak there were many who relied implicitly in the wonderful powers of these electric quacks. Nor was this strange. Murderers were taken warm from the scaffold, after the penalty prescribed by the law had been meted out, and being laid upon their backs were made to assume, in great measure, the appearance of life by means of connections made between the opposite poles of a battery and the nerves and muscles.

Imagine a man cold in death suddenly springing up into a sitting posture, swinging his arms about, rolling his eyes, and beating the air with his hands. Would it be strange, even to-day, if those ignorant of electrical science should think him come to life? Nor is it strange that eminent physicians, when they saw the heart of the dead made to beat with its wonted action, should come to the conclusion that, if this were kept up for a while and combined with artificial respiration, a restoration to life would result.

Mr. Matthew Williams has related, how that, when a child, he lived midway between Dr. Brookes's in Leicester Square and the Hunterian Museum in Windmill street, now known as the *Cafe de l'Eloïse*, formerly celebrated schools of practical anatomy and of the doings in both, tales of horror were at that time recounted.

One of these was to the effect that Bishop and Williams, who were hanged for burking—killing people in order to provide subjects for dissecting—were both restored to life by galvanism in the museum in Windmill street, as a reward for the services which they had rendered to the doctors.

The treatises on medical magnetism published at this time, abound in absurdities and exaggerations. The statements contained therein of the positive cures effected by electricity, if compared with what may now be effected through like electrical applications, are ridiculously untrue. No such cures were ever made through the agency of electricity, and it is very doubtful if they ever will be.

They were believed at the time, however, because the wonderful things that could really be accomplished through the agency of electricity, induced the public to believe that with this wonderful force nothing was impossible.

To-day we deal with a more credulous public. He who does not immediately perform that which he has asserted his ability to do in electrical science, loses its confidence.

Electrical Notes.

The contest which is about to begin between the dynamo and the secondary battery used as motors will be an interesting one in the extreme, and it is to be hoped that here in America we may settle the question beyond peradventure.

***

Dynamos are certainly very wasteful as motors on account of their high internal resistance, whereas the secondary battery will give the same amount of electromotive force with far less resistance.

***

Thus, as was recently demonstrated, for an energy of two thousand horse-power the resistance would, with the cells, be less than two ohms, but with a dynamo this will advance to four hundred ohms.

***

Of course, a high electromotive force is most economical, but the rate of revolution of a dynamo would have to be very great indeed, and the amount of friction generated as a resultant of this high rate, excessive.

***

No doubt, at some not far distant day, a means will be found to economically employ some kind of electrostatic machine or replenisher.

***

In order to obtain a current of one ampere it would be necesary to have a Faure machine charged to a volt and discharging constantly.

***

Now, as it takes four thousand volts to form a spark a millimeter long, the smallest space in which such a replenisher could be kept would be that needed for one hundred metal discs divided, and each a meter in radius distant from the inductors about a millimeter.

***

An ampere current could be produced only by the revolution on an axle of these hundred plates at the rate of 1.650 revolution a minute.

***

As is well known, in Ayrton & Perry's motor, which was illustrated in the ELECTRICAL REVIEW quite recently, the usual arrangement is reversed, the field magnets being placed between the armatures and revolve carrying brushes which revolve also.

***

Though not yet perfected, the many improvements recently made indicates that in all likelihood it will be very soon.

***

As said before, in the not distant future it will be decided whether electricity is more economically applied to the wheel of a motor or to the rail upon which it rests.

***

In the latter case, there is certainly a heavy loss of current by leakage.

***

When the secondary battery is used, such usage brings with it many advantages.

***

As each car in a train, for instance, carried its own motor, there would obviously be no necessity for making up a train, for each could run by itself, if required.

***

The future possibilities of the secondary battery, though impossible to predict, may readily be conjectured.

***

Surely if, in the present imperfect condition of the secondary, an electric launch, carrying thirty or more people, may be constructed, it would not be unreasonable to believe that, when this ingenious contrivance is perfected, it may be made to furnish sufficient power to force a great ship through the water.

***

When the first telegraph line—that between Baltimore and Washington—was constructed, it was known with certainty that such a line could be charged with electricity.

But suppose some enterprising electrician should have suggested the possibility of charging a cable three thousand miles long with electricity, and declared that it would be so sensitive as to transfer a mechanical movement from one end to the other.

***

How he would have been jeered at by the ignorant and the narrow-minded.

***

Yet would he not have been right in the conjecture?

***

And, by the way, I should like to ask right here, Where do these doubters disappear to? They cannot be found when the project which they have hooted at has proved successful.

***

Then, in the places which they occupied, every one will tell you, "That's just what I said; I always believed the thing was feasible!"

***

I believe the entomologists, or rather the dipterologists, have not yet discovered where flies go when the cold weather comes, and I would suggest to the members of the next scientific congress as an interesting question for discussion, "Where do the skeptics go when that which denied the possibility of reality comes to pass?"

***

Let us look for a moment at the present condition of the secondary battery in reference to the propulsion of large vessels.

***

For transatlantic steamers, weight of secondary batteries, as far as can be foreseen, would be an insuperable objection.

***

A steamship *en route* to Queenstown is out say, eight days, and requires, say, 1,000 horse-power.

***

As a Faure cell weighs ½ cwt., it is evident that for such a journey the dead weight would be five thousand tons.

***

But who is bold enough to say that, in the future, a means of reducing the weight of these cells will not be found?

***

At present the principal difficulty in marine engineering is that the screw, to work efficiently, must be driven at greater speed than suits the engine.

***

Hence gearing must be used to regulate the speed, and the screw must be longer and must move slower than is requisite.

***

Now, a dynamo, unlike a steam engine, requires to move even more rapidly than a screw, to work economically; and therefore, in the future, marine engineers will probably see gearing introduced to reduce the motive seed to suit the screw.

***

In the medical practice of recent years, the Materia Medica has by no means played so important a part as formerly.

***

The fact is the doctors have, to a large extent, lost their confidence in the efficacy of medicine, except, of course, in certain cases, and have fallen back upon the theory of assisting nature as much as possible.

***

That is to say, they believe that fresh air, good food and regular habits are stronger cards than jallop, the application of leeches and attenuation of aconite, bella donna and nux vomica.

***

Many first-rate practitioners have recently shown confidence in magnetism, and there is reason to believe that, in the future, magnetism will play a very important part, if not in curing at least in alleviating those ills to which humanity is heir.

A very ingenious man, though I believe not a physician, has invented a magnetic sleeping-cap, which besides, as he alleges, being a cure for insomnia, will relieve many different ailments, especially neuralgia.

***

This cap is tied with strings, somewhat like a night-cap, so as to keep it close to the face.

***

The only trouble the inventor says he has with this cap is that it is made of such heavy metal as to be somewhat uncomfortable, and he loudly demands that some one shall tell him of a thin, hard, light kind of metal that would magnetize well and retain a strong power.

***

He has, it seems, been using sheet-steel of the thickness of a copper cent.

***

He says further that he would like some one to tell him how to prepare some inorganic matter that would not dry up when it comes in contact with the human body, say about the thickness of honey or molasses, and that will not work its way throught a garment.

***

It is his intention, he says, to imbed the metal in this while it is being stitched in the garment, a course he finds necessary to prevent its shifting about.

***

He seems to have made a good many experiments with his cap, for he says he has used rosin thrown down in fat without salt, though answering very well, but the fat comes through after it has been worn a short time, and the rosin when cool sets in its original state and assists not a little in making the cap clumsy instead of light.

***

But notwithstanding these drawbacks to the comfort of his cap he seems to have scored a few successes, or at least ascertained that he is on the right track in his theory, for he says that, uncomfortable as it is, he gets much relief from it.

***

One would suppose that a man who demands so much assistance in improving that which would seem to be so defective as this cap of his, would not hesitate to ask some one to please invent a new cap for him.

***

But he doesn't do this.

***

No doubt he thinks he has done all the work himself.

***

He reminds me of an old farmer who was trying to sell his house to a stranger.

***

The latter protested that it was neither what he wished in shape or location with reference to the road.

***

"Well, now," said the farmer, "all you've got to do is to put a new roof onter it, hist her up and build a story under her, and then haul her back into the pasture about 100 yards.

***

It never seemed to strike the old fellow that it would be easier to build a new house.

***

Now, possibly, if the man with "almost perfect" magnetic cap would buy a piece of thin vulcanized india-rubber, wash it in plain water without soap to deodorize it, and, after cutting it into strips, say four inches by one inch, sew them into a bandage of double red flannel, with inch spaces between the strips, he would find that this would answer all the purposes of the metal he has hitherto used.

***

He needn't confine this bandage to the head, for it may be tied around the body for the relief of lumbago, colic, or other pains.

***

It should not, however, be worn next to the skin, nor allowed to come in contact with grease. It will retain its power for three or four years.

LEON, E. U. M., July 14, 1883.

Geo. Worthington, Esq., Editor.

DEAR SIR: God's own country and those who are endeavoring to better its condition are still progressing. The Indian has not yet purchased his new clothing, but proceeding to the banks of a muddy stream, washes them, reclines in view of passers-by, and patiently awaits Nature's work in drying them; in fact, he depends largely on Nature for everything he can't steal or beg. He or she sit on all the corners of the streets of this city, and salute one in a voice whose cadence would suit the most critical verse-maker after the following fashion:

"Niño, da mi un centaro,
Porque say muy pobre,
Tengo no Tortillas,
Tampoco Fujoles,
Da mi un centaro."

Leon is the smallest *large* city I have yet struck, with a population of 110,000. A good authority states "there are not more than 100 coats in the entire community." The window of my room in the "Hotel Diligencia," looking out on the "Zocolo," or plazza, affords a view of the best portion of the promenade, which at this writing is thronged with Indians, among which may be seen a few well-dressed people; the scene is picturesque, but significant of the wealth and enterprise of the city. The latter walk aimlessly along, importuned at every step by venders of deerskin pants, bright-colored blankets, "Baxter street" shoes, and other small ware too innumerable to mention. Just at this moment the cathedral bell tolls; every head is uncovered and many bargains are broken in the haste to uncover. Admiration is blended with pity for the fanaticism of this people; we must admire their devotion to the Church and pity the ignorance which fills the churches with gold and silver, and compels the people to live in mud huts, with but a blanket to cover their nakedness. 'Tis true that railroads, telegraph and telephone are rapidly ameliorating the condition of the country, but many years must elapse before the natives will take kindly to them.

The writer having made a sure success of the Puebla Telegraph and Telephone Company, by building for it a solid foundation, was on July 1st elected General Manager of the Central Telegraph and Telephone Company of Mexico, vice Mr. George L. Wiley, called to administer the affairs of the parent company in the city of Mexico, and as one of the firm of Delano, Harris & Co., to push their several enterprises in the Republic. Already the firm have established themselves in high favor, and as bankers, brokers, promoters and commission merchants, bid fair to open up a new field for American capitalists in this country, than which there is no other more productive of wealth, particularly when engineered by such men of experience as compose the firm aforesaid.

You have already been well informed on the progress of this company by our Mr. Wiley, and the writer having just begun his tour of inspection, cannot furnish his impressions until such inspection has been completed; let it suffice, that encouraging reports are being received from all points. Mexican capital is being enlisted, and at no time have the prospects been brighter than now. Puebla stock is much sought for, the writer having placed 1,000 shares at four just previous to his departure. A letter from Acting General Manager Bosdet, of that company, says: "Subscription list is increasing. Our Central and trunk line office in San Martine, 37 kilometers, will open for business on July 15, and other trunk lines will be established on a paying basis as fast as the season will permit."

You are probably aware that we have but two seasons in this country, and to quote after the manner of Edison:

There is a little place,
Lines of beauty on its face,
Where the climate is always torrid;
When the season is dry,
It is very, very dry,
And when it is wet, it is horrid.

If you love me, don't let any of the New York boys see that. Life insurance companies are scarce in this country, and I may not have an opportunity to make application on my return.

Wash-outs on the lines of the Mexican Central are the rule this season, and the losses must have been very severe. The writer was one week on the road from Mexico City to this point, and, notwithstanding the delay, is thankful that he was not compelled to come by the "diligencia," but shudders when he contemplates that he must use them in a short time, and don't enjoy the novelty of having one's head jammed against the roof of a coach every 15 minutes, and a prize is in store for the man who will invent a contrivance by which the roof of a coach will automatically adjust itself to the state of the roads.

Your good paper comes to hand regularly, and is much admired for the wisdom displayed therein. Until further notice, please mail to me at Queretaro, Mexico.

With best wishes for your success and happiness, I remain, as ever,

W. E. HUNTINGTON.

The Cost of Electric Lighting as Compared with Gas.

ABSTRACT OF A PAPER READ BEFORE THE LIEGE ASSOCIATION OF ENGINEERS, BY MONS. J. DUMONT, RAILWAY ENGINEER TO THE BELGIUM GOVERNMENT.

The London *Electrician* says eight years ago the electric light was only used for scenic effects in theatres or for dissolving views, but not for ordinary illumination. Since that time the number of systems for producing the electric light has become so great that it is impossible to mention all. The present paper will therefore only deal with those systems that have come more prominently into notice, viz.:

In Belgium—The Serrin, Jaspar, Siemens, Jablochkoff, Soleil, Edison, Maxim, Swan and Brush systems.

In France—The Serrin, Jablochkoff, Werdermann, Reynier, De Meritens, Lontin, Gérard, Jamin, Soleil, Gramme and Brush systems.

In Germany—The Siemens and Jablochkoff systems.

In England—The Brush, Jablochkoff, Siemens, Brockie, Crompton, Soleil, Swan and Lane-Fox systems.

In the United States—The Brush, Weston, Jaël, Edison and Maxim systems.

In Russia—The Jablochkoff and Siemens systems.

In Holland—The Jablochkoff, Jaspar and Siemens systems.

To obtain a general idea of the electric light from an economical point of view, I will first establish the cost, based upon the yield of light per horse-power, irrespective of any particular system, and then the actual cost of various installations on different systems, calling the former "general prices" and the latter "actual prices."

GENERAL PRICES.

In the following observations the unit of luminosity will be taken as that produced by a Carcel lamp (9.6 standard candles) burning 42 grammes (nearly 1½ oz. avoirdupois) of refined colza oil per hour; 7 centimes (nearly ¾d.) as the cost of a horse power produced by steam-engine; and, in comparison with gas, the burner consuming 140 liters (nearly 5 cubic feet) of gas per hour with the intensity of a Carcel flame. In practice a horse-power is capable of producing 200 Carcel flames with large single-light electric arc lamps; 100 Carcels with medium single-light ditto; 50 Carcels with Jablochkoff "candles" and some forms of regulator; 25 Carcels with incandescent lamps *in pleno*, and 10 Carcels with some incandescent lamps *in vacuo*.

The cost per hour in carbons for electric lamps may be put as follows:

15 cents (1½d.) for large lamps of 500 Carcels.

18 cents (1¾d.) for medium lamps of 250 Carcels.

10 cents (1d.) for small lamps of 150 Carcels.

15 cents (1½d.) for Jablochkoff candles of 50 Carcels.

6 cents (½d.) for Werdermann lamps of 25 Carcels.

The cost of fittings amounts to 2,000 francs (£80) for a large lamp, 1,800 francs (£72) for a medium lamp, 1,000 francs (£40) for a small lamp, 500 francs (£20) for a lamp of from 25 to 50 Carcels, and 60 francs (48s.) for an incandescent lamp *in vacuo*.

By means of the above data the cost price of illumination by the electric lamps of various intensities may be arrived at, with the supposition of the following durations of lighting:—600 hours yearly for installations where illumination is only required for certain periods of the year; 1,500 hours for house lighting, and 4,000 hours for cases in which the illumination extends over at least 10 hours a day:

1. COST OF LIGHTING PER HOUR WITH LAMPS OF 500 CARCELS.

	PERIOD OF ILLUMINATION.		
	600 HRS. cts.	1,500 HRS. cts.	4,000 HRS. cts.
Motor—3-horse power, at 7 cents	12.0	21.0	21.0
Carbons	15.0	15.0	15.0
Interest on capital and depreciation of installation (2,000 francs=£80) at 12 per cent. per annum	40.0	13.3	6.0
Totals	76.0	49.3	42.0

2. COST OF LIGHTING PER HOUR WITH LAMPS OF 250 CARCELS.

Motor—2½-horse power at 7 cents	17.5	17.5	17.5
Carbons	18 0	18.0	18.0
Interest on capital and depreciation of installation (1,800 francs=£72) at 12 per cent. per annum	35.0	14.4	5.4
Totals	70.5	49.9	40.9

3. COST OF LIGHTING PER HOUR WITH LAMPS OF 150 CARCELS.

Motor—1½-horse power at 7 cents	10.5	10.5	10.5
Carbons	10.0	10.0	10.0
Interest on capital and depreciation of installation (1,000 francs=£40) at 12 per cent. per annum	20.0	8.0	3.0
Totals	40.5	28.5	23.5

4. COST OF LIGHTING PER HOUR WITH LAMPS OF 50 CARCELS.

Motor—1-horse power at 7 cents	7.0	7.0	7.0
Carbons	15.0	15.0	15 0
Interest on capital and depreciation of installation (500 francs=£20) at 12 per cent. per annum	10.0	4.0	1.5
Totals	32.0	26.0	23 5

5. COST OF LIGHTING PER HOUR WITH LAMPS OF 25 CARCELS.

Motor—1-horse power at 7 cents	7.0	7 0	7.0
Carbons	6.0	6.0	6.0
Interest on capital and depreciation of installation (500 francs = £20) at 12 per cent. per annum	10 0	4 0	1.5
Totals	23.0	17.0	14.5

6. COST OF LIGHTING WITH INCANDESCENT LAMPS OF 1 CARCEL.

Motor—0.1.horse power at 7 cents	0.7	0.7	0.7
Carbons (if lamps cost 5f. = 4s. and last 1,000 hours)	0.5	0.5	0.5
Interest on capital and depreciation of installation (60 francs = 48s.) at 12 per cent. per annum	1.2	0.4	0.18
Totals	2.4	1.6	1.38

The prices thus established are for (1) illumination from a great distance with Serren, Siemens or Brush regulators, (3) with Jasper or Siemens regulators, (4) with Jablochkoff candles and (5) with Werdermann incandescent lamps.

On the other hand, the cost of laying down gas in works is, on an average, 30 francs (24s.) per burner, consuming 140 liters (nearly 5 cubic feet) of gas per hour, and giving the light of 1 Carcel flame. Therefore the light of a gas-burner costs per hour the following prices, according to the charge, whether 30 cents (3d.) or 15 cents (1½d.) per cubic meter (35.3 cubic feet); that is to say, 7s. or 3s. 6d. per 1,000 cubic feet.

	Period of Illumination. 600 hrs. Cents.	1,500 hrs. Cents.	4,000 hrs. Cents.
Gas burned 140 liters per hour, at 30c. per cubic meter	4 2	4.2	4 2
Interest and depreciation on 30f. (24s.), at 12 per cent. per annum	0.6	0.2	0.1
Totals	4.8	4.4	4.3
Gas burned, 140 liters per hour, at 15c. per cubic meter	2.1	2.1	2.1
Interest and depreciation on 30f. (24s.), at 12 per cent. per annum	0.6	0.2	0.1
Totals	2.7	2 3	2.2

By means of these comparative cost prices for electric and gas lighting, the following table has been compiled, in which the prices are reduced to the Carcel flame (9.6 standard candles) taken as the unit of luminous intensity:

	Cost per Carcel per Hour. 600 hrs. Cents.	1,500 hrs. Cents.	4,000 hrs. Cents.
1. Gas burner, yielding a flame equal to 1 Carcel, and consuming 140 liters per hour, at 30c. per cubic meter	4.80	4.40	4.29
2. Similar gas burner, with gas at 15c. per cubic meter	2.70	2.30	2.20
3. Electric lamps of 500 Carcel units	0.15	0.10	0.08
4. Electric lamps of 250 Carcel units	0.28	0.19	0 16
5. Electric lamps of 150 Carcel units	0.27	0.19	0.16
6. Electric lamps of 50 Carcel units	0.64	0.52	0.27
7. Electric lamps of 25 Carcel units	0.92	0.98	0.58
8. Electric lamps of 1 Carcel unit (incandescent *in vacuo*)	2.40	1.60	1.38

If the electric light could be usefully distributed in the space to be illuminated, it would in all cases be more economical than gas; but practical experiments show that 20 ordinary gas burners can only be replaced by an electric lamp of 250 Carcels (2,400 candles), by two lamps of 50 Carcels (480 candles), or by four of 25 Carcels (240 candles). In this case, as in all cases where it is adopted, a total illuminating power is obtained which is greater than that yielded by the gas which it has replaced.

ACTUAL PRICES.

Illumination of the Telegraph Office at the Brussels Northern Terminus by the Jaspar System.—This is effected by three Jaspar regulators, which supersede 70 gas burners, each consuming 140 liters per hour, each regulator having a luminous intensity of 235 Carcels (2,256 candles). The comparative cost of producing the light, calculated for a daily period of four hours, is, therefore, as follows:

Electric Light.

Motive power	2f. 84c.
Carbons	0 56
Interest and depreciation, at 10 per cent.	0 42
Total for electric light (Jaspar)	3f. 82c. (3s. 0½d.)

Gas.

Consumption of 70 burners, at 15c. per cubic meter	1f. 45c.
Breakage of glasses	0 15
Interest and depreciation, at 10 per cent.	0 24
Total for gas	1f. 84c. (1s. 5½d.)

Whence it follows that the electric Carcel unit costs 0.0054f., and the gas ditto 0.0265f. Be it remarked, however, that the motive power is obtained from a gas engine, which is dearer than steam.

Illumination of the Telegraph Office at the Brussels Northern Terminus by the Jablochkoff System.—In accordance with an estimate made in 1879, the illumination of the same room would require six Jablochkoff candles of 40 Carcels each, the cost per hour being—

Motive power	2f. 840c.
Carbons	0 900
Interest on capital and depreciation, at 10 per cent. per moment	0 387
Total (Jablochkoff)	4f. 127c.

or 0.017f. per Carcel per hour, compared with 0.0265f. for gas.

Illumination of the Place des Nations, Brussels, by the Jaspar System.—Admitting a daily mean of six hours, the cost is—

Electric Light.

Motive power	2f. 69c.
Carbons	0 56
Interest and depreciation, at 10 per cent. per annum	0 29
Total (Jaspar)	3f. 54c.

Gas.

Gas consumed	1f. 02c.
Interest and depreciation, at 10 per cent. per annum	0 19
Total (gas)	1f. 21c.

As the total intensity of the electric light is 705 Carcels, and that of the gas about 40, the cost of the Jaspar Carcel is 0.00502f. per hour, and of the gas 0.03f.

LOWELL, July 23, 1883.—An important meeting was held at the office of the Lowell syndicate in this city to-day. There were present William A. Ingham and Loren N. Downs, representing the Weston Electric Light Company of Lowell; Edward H. Goff and William A. Hovey, representing the American Electric and Illuminating Company of Boston; and the Middlesex Electric Light Company of Lowell was represented by its president, Mr. George W. Fifield. The Hon. D. W. Gooch was present as counsel. The result was an agreement under which the Weston Company of Lowell is to transfer all of its plant and business to the Middlesex Company, which will substitute lamps and dynamos of the "American" or Thomson-Houston system for the Weston apparatus which it is to acquire, throwing out the Weston system entirely. The Weston Company here is to wind up its business and surrender its charter. Messrs. Ingham and Downs, well known as the leading spirits in the Lowell telephone syndicate, were this afternoon chosen directors in the Middlesex Company. In this way a fierce struggle for the supremacy between the Weston and "American" systems has been amicably adjusted, and the "American" remains in sole possession of the field.

An Operator Shot.

NEW YORK, July 24.—A special from Atlanta, Ga., says at 10 o'clock this morning a pistol ball was fired through the window of the Western Union Telegraph office here, shivering the large plate glass and striking the receiving clerk "Witt" just above the hip. The ball was spent, however, and the injury was not serious. The range of the ball indicates that it came from an up-stairs room of the Markham Hotel, across the street. "Witt" withdrew from the Brotherhood the day before the strike.

Flippin, the Old Reliable Superintendent, is holding down the telegragh office here. "Flip" as he is called by his familiar friends has been in the service of the Western Union 17 years, and has always held his own, like the boy that stood on the burning deck—through sunshine, storm, rain, and yellow fever epidemics. You bet your lip, that faithful Flip, will never skip, as long as there holds out a single fellow at the other end of the wire to hand him in the links of chained lightning.—*Vicksburg Herald.*

The strike is a twice-told tale. Let it be ended.

NEW PATENTS—ELECTRICAL—1883.

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JULY 10, 1883.

281,049 Armature for dynamo-electric engines; Warren P. Freeman, New York, N. Y.

281,176 Apparatus for measuring the amount of current energy received by a secondary battery; Charles F. Brush, Cleveland, Ohio.

281,202 Automatic electric-circuit breaker; Lucius J. Phelps, New York, N. Y.

280,919 Conduit for underground electric wires; James Du Shane, South Bend, Indiana.

281,064 Conduit for underground lines for telegraph and other wires; William Hendley, Washington, D.C.

281,175 Current manipulator for secondary battery charging; Charles F. Brush, Cleveland, Ohio.

281,052 Dynamo-electric machine; J. Edwin Giles, Hazleton, Pa.

280,869 Electric underground cable; Frank A. Smith, Macomb, Ill.

280,906 Electric fire extinguisher and fire-alarm system; Charles F. Buell, New Haven, Conn.

281,048 Electric carbon; Herman Frasch, Cleveland, Ohio.

281,097 Electrical exercising apparatus; William T. McGinnis, New York, N. Y.

281,223 Electrical conductor; Hiram D. Rogers, New York, N. Y.

281,224 Electrically-heated mirror; Benjamin H. Goodsell, Charles Adamson, and Carl O. Hering, Philadelphia, Pa.

280,933 Galvanic battery; William W. Karschner, Washington, D.C.

280,947 Insulator for electrical conductors; Percy C. Ohl, Plainfield, N. J.

280,882 Process of treating alcoholic liquors with electricity; Anson C. Tichenor, Alameda, Cal.

281,182 Printing telegraph; Stephen D. Field, New York, N. Y.

281,117 Quadruplex telegraph; Alexander Muirhead, London, England.

281,118 Quadruplex telegraph; Alexander Muirhead and George K. Winter, London, England.

281,136 Secondary battery or electric accumulator; Eli T. Starr, Philadelphia, Pa.

280,800 Telephone receiver; Louis J. Crossley, Halifax, County of York, England.

280,850 Tower for electric lights; Benjamin F. Orton, East Saginaw, Michigan.

280,916 Telephone and telegraph protector; Charles C. Drake, Trenton, N. J.

280,948 Telephone call; Percy C. Ohl, Plainfield, N. J.

281,000 Telephone receiver; Joseph F. Batchelor, Baltimore, Md.

281,220 Ventilating conduits for electric wires and adjusting the wires in the same.

WEEK ENDING JULY 17, 1883.

281,407 Acoustic telephone; Charles Selden, St. Louis, Mo.

281,412 Automatic regulator for incandescent lamps; Eli T. Starrs and E. Eugene Starrs, Philadelphia, Pa.

281,613 Automatic telephone exchange; George A. Cardwell, Brooklyn, N.Y.

281,285 Carbon electrode for electric lights; John A. Moffitt, Arlington, Mass.

281,603 Circuit closer; Charles Bartlett, Providence, R. I.

281,353 Dynamo or magneto electric machine; Thomas A. Edison, Menlo Park, N. J.

281,416 Dynamo-electric machine; Elihu Thomson, New Britain, Ct.

281,229 Electric lamp; Clinton M. Ball, Troy, N. Y.

281,345 Electric gas-lighter; Charles H. Crockett, Boston, Mass.

281,351 Electrical generator; Thomas A. Edison, Menlo Park, N. J.

281,302 Electric switch; David P. Heap, U. S. Army.

281,41 Electric telephones; J. Milton Stearns, Jr., Brooklyn, N. Y.

281,471 Electric gas-lighter; William A. Drysdale, Philadelphia, Pa.

281,202 Galvanic battery; John W. Gilbert and Eli T. Starr, Philadelphia, Pa.

281,363 Imitation telegraph key; Louis H. Hart, New York.

281,450 Individual signaling apparatus for telephones; James H. Cary, Boston, Mass.

281,614 Individual telephone call; James H. Cary, Boston, Mass.

281,330 Multiplex telegraph; Edward A. Calahan, Brooklyn, and Patrick B. Delany, New York, N. Y.

281,406 Mechanical telephone; Charles Selden, St. Louis, Mo.

281,249 Quadruplex telegraph; Georges D'Infreville, New York, N. Y.

281,349, 281,350 Regulator for dynamo-electric machines; Thomas A. Edison, Menlo Park, N. J.

281,576 Safety-catch for electric light circuits; Luther Stieringer, New York, N. Y.

281,585 Synchronizing clocks; Gustavus G. Wagner, Mount Vernon, N. Y.

281,452 Telegraph insulator; Thomas L. Chapman, Huntington, W. Va.

281,361 Telephone support; Charles T. Loring, Boston, Mass.

281,413 Telephone circuit; J. Milton Stearns, Jr., Brooklyn, N. Y.

281,476 Telephone system and apparatus; Isaiah H. Farnham, Portland, Me.

281,560 Telephone; J. Harris Rogers, New York, N. Y.

281,340 Telephone transmitter; Joseph H. Cheever, Somerville, Ma ss

Manufacturing News.

Anderson, S. C., is raising $100,000 to build a cotton factory. J. N. Brown is in charge of the enterprise.

W. T. Parham, of the Maryville (Tenn.) Woolen Mills, is preparing to erect a two-story addition to the present mills. It will be of brick, 36x80 feet in size.

The preferred 8 per cent. stock of the American Electric and Illuminating Company is quoted at $12 and upwards, and the common stock at $7.50 to $8. The regular 4 per cent. dividend is payable in September.

The directors of the Mathews cotton mill, at Selma, Ala., have decided to double the capacity of the mills by erecting another building similar to the one now used, and increasing the number of spindles from 4,000 to 10,000.

A stock company with $50,000 capital has been organized in Chattanooga, Tenn., to build an extensive chair factory. The factory building is to be located on the river, near the Roane Iron Works, and will have a large capacity.

Hereafter, the steamship Great Eastern is to be employed in carrying Scotch coal from the Forth to the Thames. She will be able to carry about 20,000 tons on each voyage, and from this fact the owners are led to hope that the scheme will be remunerative. They already talk of annual dividends of five per cent.

The Merchants' Electric Light and Power Company, Boston, will be fully organized next week, and assume the local lighting business for Boston and vicinity. The September division of funds in dividends, as stated in another column, will be about $25,000, and the company is said to have enough cash on hand from earnings to pay more than two similar dividends.

The Toledo Bolt and Nut Company are erecting buildings in the Fifth Ward, on a switch of the L. S. & M. S. R. R. The foundations and engine-house are of brick and stone, and are now completed. The main building is 200x50, one wing 50x80—all two stories high; also an engine-house 30x30, and a milling furnace 50x50. The buildings complete, ready for the machinery, will cost the company about $15,000.

The company will change its name from the Mansfield Bolt and Nut Company to the above name.

Bids for New War Vessels.

The bids for the construction of the three steel cruisers and the dispatch boat ordered by the last Congress, were opened July 2 in Washington, and it was found that John Roach & Sons' bids were lower in every single instance than any others, and they will probably be awarded the contracts.

For the 4,500-ton steel cruiser C. H. Delamater & Co., New York, bid $1,163,000; the Harlan & Hollingsworth Company, Wilmington, $1,120,000; Cramp & Son, Philadelphia, $1,080,000; John Roach, Chester, $889,000. Each bidder sent in a $30,000 certified check with his bid.

For the 3,000-ton steel cruiser the following bids were made: The Harlan & Hollingsworth Company, $777,000; Harris, Loring & Co., Boston, $748,000; Cramp & Son, $650,000; John Roach & Son, $619,000.

Each bidder sent in a $20,000 check.

For the 3,000-ton cruiser the following bids were made: Harlan & Hollingsworth Company, $775,000; Quintard Iron Company, New York, $763,400; Cramp & Sons, $650,000; John Roach, $617,000.

Each bidder sent in a $20,000 check.

For the dispatch boat bids were made: H. A. Ramsey & Co., Baltimore, $420,000; Allen & Blaisdale, St. Louis, $380,000; Cramp & Son, $375,000; John Roach, $315,000.

It is believed in Washington that the vessels can be built and finished in eighteen months, if the armament can be procured in time.

Articles of incorporation of the California Jute Mill Company, at San Francisco, have been filed with the County Clerk. The directors are F. W. Zelle, John F. Sheelly, L. P. Drexler, George H. Bryant, George C. Bode, Emile Sutro, and J. D. Whitney. The capital stock is $180,000, of which $98,250 have been subscribed.

For the week ending July 17 five patents were issued to Thomas J. Edison, of Menlo Park, N. J., for improvements in electric light and dynamo-electric machines. Perhaps Edison was right when he said his light was perfected and nothing more required. If so, how previously previous was all that newspaper talk and buncomb advice.—*Philadelphia Press.*

The public is respectfully informed that the strike has not extended to the Legislature. The members are entirely satisfied with their pay.

A thing to be glad of is that there has been no outcropping of the crank in the strike.

The electric bell fixtures in the Car "Railway Age," presented to Mr. E. H. Talbot, editor of the *Railway Age*, by manufacturers of railway appliances, were made by the Western Electric Co. This elegant car could not be duplicated for $20,000.

The following notice has been issued by the Bell Telephone Company, of Philadelphia:

We beg to notify the patrons of the Bell Telephone Company of Philadelphia that hereafter, and until further notice, all persons entitled to examine instruments or wires belonging to this company connected with their establishments will, in addition to the regulation badge, be provided with written authority from an officer of this company, good for that day only. Failing to produce such authority, admittance should be promptly denied.

By order of the General Manager.
ROBERT MORTON, Supt.

The large duplicate switch-board recently built by the Western Electric Company of Chicago, for the Minneapolis Exchange, friend Denman states is working admirably.

With its issue of July 15th *The Two Republics*, published in the City of Mexico, becomes a daily paper. The success of this news paper has been remarkable, and reflects great credit upon the publishers, Messrs. Clarke & O'Dwyer. In making this new departure they extend the scope of their work and devote somewhat more space to railroads, mining, and general financial and commercial interests of our 'sister republic." There exhausting the value of their mediums between the seller and buyer not only in Mexico, where this is an essential element of progress, but in the United States to whom our Mexican brother looks for help and encouragement, the new title of our contemporary is designed with special reference to unite more closely the two republics which it seeks so ably to represent. The "make up," printing and paper are all that is required to make an attractive, readable daily newspaper.

BUSINESS NOTICES.

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Address, with statement of age, references and salary expected, "Company," care of the ELECTRICAL REVIEW.

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SITUATION WANTED.—A capable and industrious young man, who has had over two years' practical experience, desires a situation with an electric light company to run dynamo machines; can adjust and regulate lamps, run line wires, &c. Address "Experience," P. O. Box 3329, N. Y. City.

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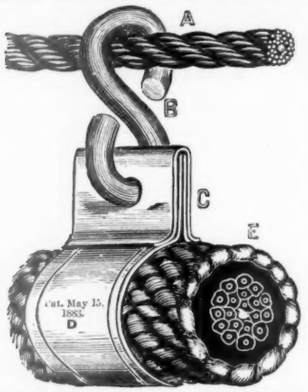

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VIENNA, 1883.

The Commission of the International Electric Exhibition at Vienna, 1883, gives due notice to the public that this Exhibition is to take place in the course of this year, to be opened on the **1st August,** and to be closed on the **31st October,** and cordially invite Exhibitors and Visitors. The Regulations and the blanks necessary for Applications are to be had at the **Austrian-Hungarian Consuls.** The objects to be exposed will comprise all Machinery, Apparatuses and Implements connected with Electrotechnic It will certainly afford a good opportunity to inventors to show their latest improvements. This Exhibition is greatly favored by the Austrian Government, and will be held in the Rotunda of the well-remembered Universal Exhibition of 1873. Exhibitors are requested to procure the necessary papers at once.

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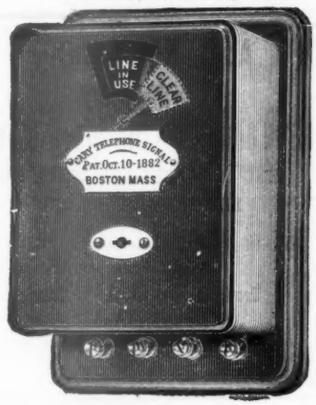

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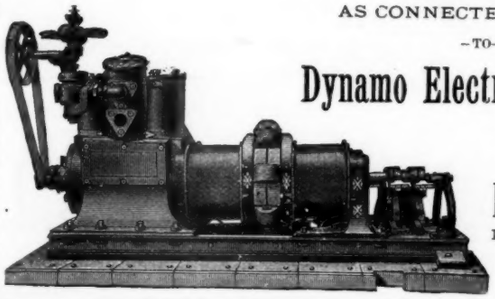

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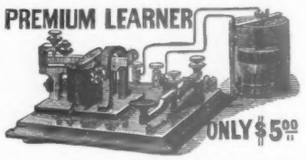

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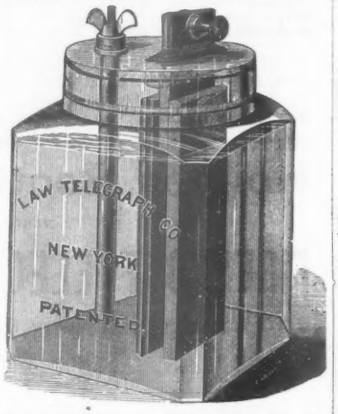

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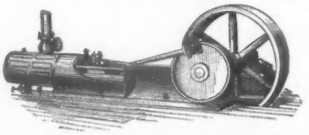
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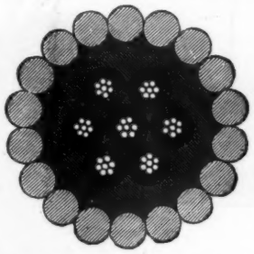

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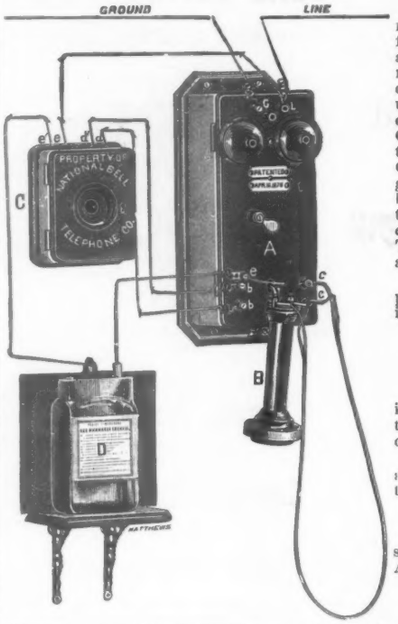

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